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Future of Refrigeration

Openings for Progress

UPON the reorganisation which took place about a year ago the Commercial Electric Refrigeration Association became thoroughly representative of the industry, embracing manufacturers, insulation contractors, distributors and service engineers. This comprehensive arrangement arose out of what was, after all, quite an extraneous object—the securing of economy in tyres and petrol.

From this purely wartime measure permanent benefit will be derived, for although the three sections into which the Association is divided are autonomous, the constitution provides for the closest co-operation between them on all matters of common interest. Some indication of what these matters are is given in the report covering the first year's activities: they include what was the primary reason for the getting together—rationalisation of service; Government bulk buying (accepted now but likely to be a contentious subject later); the training of apprentices; supplies of freon and other necessaries; fair trading; and liaison with Government Departments.

Home and Export

It is often said that our climate is not such as to provide so great a scope for refrigeration as exists, for instance, in the United States. This may be true, but the matter should be viewed not merely as a home marketing problem; the export side may prove of as great importance and the remarks of Mr. E. G. Batt, the Association's independent chairman, at last week's luncheon proved that this fact is being given due weight in the forming of future policy. He hinted that in the allocation of materials after the war there might be a stipulation that a proportion of them should be used in producing goods for export.

Major Post-War Development

However that may be, the home market will be the first consideration. Professor Sir Jack Drummond, Scientific Adviser to the Ministry of Food, whose forthright views carried conviction, considered that refrigeration would be a major post-war development, giving good reasons why that should be so. He made particular reference to the quick freezing process, which was gaining ground here before the war; refrigerated transport; the possibilities of communal food-storing systems; and the use of refrigeration methods in the dehydration of food—possibly on the lines now adopted for the preservation of plasma for blood-transfusion purposes. He stressed the value of research.

We believe that the idea of refrigeration already has a firm hold upon the public. What they want is to be able to acquire equipment at a reasonable price and be sure of efficient service to keep it running. While the gas industry made a good deal of headway in the disposal of domestic units before the war, we consider this to be pre-eminently an electrical service. Work is now in progress upon the design of an electric refrigerator for household use which will be standardised to such an

extent that the unit can be immediately replaced by another produced by any one of a number of makers.

One important point is that stressed by Mr. E. E. Hoadley at the luncheon: the domestic refrigerator must be of adequate size. Too-small units may damn the whole idea of domestic refrigeration. We believe that the design now being evolved will meet this requirement. Mr. Hoadley also assured the refrigerator industry of the electricity supply authorities' support which should prove valuable.

Television

WHILE economic rather than technical factors are likely to hamper progress of television in the immediate post-war years, there would appear to be a greater obstacle than either to the prospects of establishing the improved service that Mr. B. J. Edwards envisaged in his I.E.E. Wireless Section paper last week. Even if, for the sake of national prestige, television, in which British engineers have hitherto been to the fore, were to be fostered by public subvention, there would still remain the difficulty (well-nigh insuperable without effective international agreement) of the allocation of wavelengths. Priority would presumably be given to such strictly utilitarian requirements as long-distance telephony and radiocommunication between mobile points, including ships and aircraft. The report of the new Television Committee will be awaited with interest.

Open-Cast Coal Costs

ANOTHER three shillings has recently been added to the price of a ton of coal and consumers, hoping that it is really necessary, have resigned themselves to paying it. But this resignation does not extend to the price of open-cast coal which also has to bear the same burden. Power station owners in the Mid East England area recently decided to withhold payment of the extra cost so far as this fuel was concerned, considering that the reasons given for the increase in the price of mined coal did not apply. They are particularly annoyed because they have accepted open-cast coal, which is of inferior quality, as a contribution to the easing of the fuel situation—not because they wanted it. It is maintained that there should be a disclosure of the cost of winning this coal, which, it is apparently believed, is not so great as for mined coal. Another point which seems to arise is whether the men engaged on the work are miners, for whom the extra three shillings is being collected.

Municipal Rift

As we suggested last week, the municipal owners of selected stations do not view with favour the proposal of the I.M.E.A. that their stations should be handed over to the Central Electricity Board. At their meeting on February 23rd, representatives of these municipal authorities expressed strong opposition to the suggestion and set up a committee to watch their interests. They maintained that so far from leading to lower and more uniform charges to consumers this handing-over would actually have the opposite effect. In these circumstances it is a matter for conjecture as to why the I.M.E.A. went so far as to prepare what looks like a final document on the subject and who was responsible for it. No doubt on a mere counting of heads the smaller members of the Association could carry any proposals of this nature, but it was surely unwise to let it happen.

Short-lived Secrecy

WHEN we refer to a "matter for conjecture" we mean what we say, for in all these matters we see through a glass darkly. The electrical Press is occasionally given confidential snippets of information with the strict injunction to keep quiet for the time being. A day or two afterwards reports appear in the daily papers of remarks made by local speakers in which the whole business is disclosed—generally in a garbled or misleading manner. It is extremely difficult to keep secret information possessed by a large number of people. It would be much better to issue some form of official statement to guard against the publication of mangled versions of what is happening.

J.E.A. Criticisms

THE battledore-and-shuttlecock procedure, now becoming so wearying, is taken up by the London & Home Counties J.E.A. in a report upon the two recent memoranda. The joint proposals by the company and municipal associations are pretty thoroughly damned because they are held to favour companies at the expense of municipalities. Apart

from the merits of the proposals, there is some force in the suggestion in the J.E.A. report that the real position of the I.M.E.A. is not clear in view of the nature of its own memorandum on the subject. This memorandum fares little better at the J.E.A.'s hands, and as regards the transfer of selected stations to the Central Electricity Board it is suggested that other public bodies concerned might have been consulted in the matter.

Group Q.C.

THE adaptability of quality control to any particular set of circumstances is well illustrated by its application in a London works, which is described in detail in the *Production and Engineering Bulletin* for February. Here components are being made on a number of six-spindle automatics, one set of control charts being used for the whole group of tools. The group charts are based on principles adopted for individual working, as previously described in our columns, and their introduction has appreciably reduced the amount of clerical work involved. The factory concerned is quite small, confirming the general experience as to the suitability of the system for any works engaged on repetition work, irrespective of size.

Gas Difficulties

IT is impossible not to sympathise with the London gas companies which seem to have been even more hardly treated by the war than their electrical competitors. Mr. Frank H. Jones told the stockholders of the Commercial Gas Co. last week that the company was in serious financial straits, mainly through loss of consumers from bombed areas in London. They had been forbidden to raise prices to an economic level and the only assistance afforded them was in the form of interest-free loans. The Minister of Fuel and Power expected them to carry on at a heavy loss and had refused any subsidy. As a consequence they were unable to meet their obligations and would later suffer from a shortage of money for re-development.

Doubtful Comparisons

MR. JONES went on to compare the company's present position with that of the municipal electricity undertakings in the East End of London which, he said, were able to make up deficits from the rates. This is true, but it is not the whole truth. Mr. Jones omitted to say that this was largely a return of moneys already taken from the undertakings for rate relief in earlier years, and in other respects the comparison is not a just one. He might have compared the Commercial Gas Co.'s position with that of the London companies. They, too, have suffered from the war and while being restricted in the matter of charges have not received State assistance. Of course these undertakings may be in a better position as owners of selected stations. The output of these stations, being needed for the grid, has not been cut down but still the cost of production and therefore of energy for their own requirements has been considerably increased.

Wiring Regulations

IT is a great convenience to have incorporated in the text of the I.E.E. Regulations the various modifications made since the present edition came into force a few months before the war. The revised eleventh edition (which is reviewed in this issue) does not cover the use and installation of polyvinyl-chloride-insulated cables, for which reference must be made to B.S. 1062/1943 (Amendment Sheet PD 202), particulars of which were given by us on January 28th. Current ratings for cables remain as before, indicating that the more liberal allowances made by the War Emergency Relaxations of the I.E.E. Regulations are not regarded as permanent.

Arc-Suppression Coils

ALTHOUGH the occurrence of two earth faults at the same time may be uncommon on modern well-maintained overhead lines, it is a contingency that has to be allowed for. Its possibility has provided the principal argument in favour of automatically short-circuiting an arc-suppression (Petersen) coil after a short time interval, whereas it may be desirable to keep it alive (especially in rural areas), even though the fault be sustained, to permit location and repair of the defect. The use of a wattmeter relay of the sensitive type described by Messrs. L. B. S. Golds and C. L. Lipman to the I.E.E. Measurements Section last Friday appears, provided accurate current transformers are employed, to offer a reliable means of indicating or immediately disconnecting a second fault.

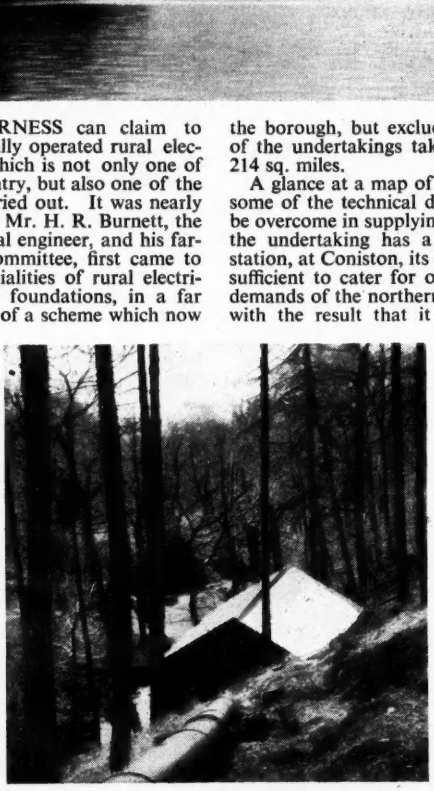
Developing a Rural System

Experiences at Barrow-in-Furness

BARROW-IN-FURNESS can claim to have a municipally operated rural electricity scheme which is not only one of the largest in the country, but also one of the first to have been carried out. It was nearly twenty years ago that Mr. H. R. Burnett, the then borough electrical engineer, and his far-sighted Electricity Committee, first came to appreciate the potentialities of rural electrification and laid the foundations, in a far from promising area, of a scheme which now brings electrical facilities to virtually every village and hamlet, in fact, almost every house.

Rural development may be said to date from 1926 when the Town Council obtained a Special Order which, together with the original Lighting Order of 1894, gave the undertaking authority to supply electricity in Furness, with the exclusion of the small areas served by the Ulverston and Grange-over-Sands Urban District Councils and the Cark & District Electricity Supply Co. (to all of which, as well as the South Cumberland Electricity Supply Co. and the Millom Rural District Council, are now given bulk supplies). A Special Order was obtained in 1931 to extend supplies east of Grange to the Meathorp area of Westmorland. Altogether the area covered by the Council, including the 16 sq. miles of the borough, but excluding the 17 sq. miles of the undertakings taking bulk supplies, is 214 sq. miles.

A glance at a map of the district will show some of the technical difficulties that had to be overcome in supplying the area. Although the undertaking has a small hydro-electric station, at Coniston, its capacity of 300 kW is sufficient to cater for only a fraction of the demands of the northern portion of the area, with the result that it is necessary to rely almost entirely on supplies from the Corporation's main steam station in the town, some twenty-five miles distant as the crow flies from the limits of the area. There are three ranges of mountains running north and south and development is mainly confined to the valleys. Further, the inclusion in the area of Lakes Windermere and Coniston, the Tarns and other well-known beauty spots, has curtailed the use of overhead lines on the score of preservation of amenities. Actually, underground mains have been laid along the side of Lakes Windermere, Coniston and Esthwaite Water, and where underground mains are employed, owing to the rocky nature of the ground, blasting has been necessary in almost every instance. Blasting has also been required in the excavation of about half the holes for



The hydro-electric station at Coniston

overhead lines. Moreover, in the rural area there are only about 43 prospective consumers per square mile.

Despite these obstacles the first section of the scheme was inaugurated in 1925 and gradually extended until to-day the whole area is covered. In view of the comparatively small return that could be expected on the capital expenditure, it was necessary to restrict the cost of the work entailed to reasonable limits and to forgo for the time being a number of features very desirable in a scheme of this nature.

With the growth of the undertaking the absence of these features has made itself more and more conspicuous and it was one of Mr. J. E. Shepherd's first tasks on his appointment as borough electrical engineer in 1938, in succession to Mr. Burnett, to prepare a scheme for the development of the system. The three main aspects of the problem with which he was confronted were the need for improving facilities for repair and maintenance, voltage regulation and, what is equally vital to a rural area, fault discrimination.

The position as Mr. Shepherd found it was that, with the piecemeal growth of the undertaking, what were originally constructed as transmission lines became, at a later stage, distributors, and long spur lines had been run off. Furthermore, while distribution in the urban area was carried out at 6,000 V, that of the rural area was at 11,000 V, so that as the system expanded interconnection became increasingly difficult. For voltage regulation at the extremities of the system, the Coniston station was useful to a certain extent.

The development scheme now partly achieved provides, among other things, for new and duplicate feeders (underground wherever possible) to the main distribution points; use of old combined trunk and distributors as distributors; establishment of new main distribution points farther away from the power station; the division of the

One of the new main distribution points at Greystones, with two 11-kV overhead lines serving a portion of the rural area

area into three or four sections, each equipped with a Petersen coil (Mr. Shepherd has his doubts as to the efficiency and safety of a single Petersen coil serving a large constantly growing network of mains comprising underground and overhead lines); the provision of ring mains wherever possible; the use of larger conductors or, failing that, the provision of e.h.v. voltage regulators; and the widespread use of pilot protection.

Under the system of protection originally adopted adjustable, inverse and definite time relays were employed without pilot protection. These give overload protection only, and in the event of a line coming down on the ground or to earth, the full load current must be passed before the protection operates and the switch opens. Protection operates between substations at half-second intervals and since, in some cases, no fewer than seven substations have been so equipped in series, a 3½-second relay setting has been necessary. Normally two

To preserve amenities underground mains have been laid close to beauty spots in the area, which include Tarn Haws (left) and Lake Windermere (heading picture)

seconds is considered quite long enough to subject generators and transformers to fault conditions. The position is not made any simpler by the fact that, owing to the rock formation, good earths are unavailable. Under the scheme now in hand it is proposed to split the area into a few protected sections, consisting of pilot protection of underground transmission feeders between Barrow and Ulverston and of the overhead e.h.v. ring distributors, the latter being protected by overload and line linkage relays.

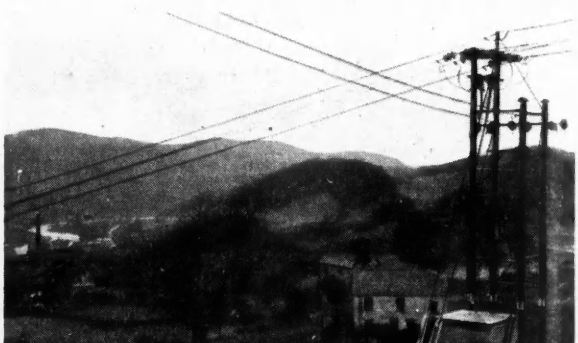
Owing to its geographical situation and geological formation the area is very prone to "outages" due to lightning. Not yet having found a lightning arrestor that satisfies him, Mr. Shepherd has endeavoured to make the flash-over values of all the apparatus—line insulators, switches, transformer bushes, etc. —the same, and has then deliberately inserted a weak section at a convenient position near a main substation. With regard to the earthing difficulties already referred to, a continuous earth wire is always employed for the 11-kV overhead system, while on the low-voltage side it is the practice to have lighting installations and other circuits fitted with earth-leakage trips. No protective multiple earthing has been attempted. Starlings have provided another problem, and if a flock settles on the lines the weight is often sufficient to make a pair touch, and cause outages. The solution has been the use of stretchers between the wires.

A typical section of the low-voltage main system at Coniston

To simplify maintenance and service and the stocking of spare parts, apparatus has been standardised to a very considerable degree, and the practice has been adopted of giving the contract for the whole of one particular type and size of apparatus to one manufacturer. For instance, the cookers used are small size, Revo; medium size, English Electric; and large size, Hotpoint. Similarly, the main switchgear is Metrovick; low-voltage, B.E.T.; and rural gear, Ferguson Pailin. Four standard sizes of cartridge fuse carriers cover all requirements up to 800 A.

Upon the completion of the scheme of reorganisation outlined the Electricity Department will be in a very favourable position financially, as the stage has now been reached when the repayment of a large number of the loans obtained falls due for completion. As it is, practically half (£675,682) of the £1,419,963 has already been repaid, and as the other loan repayments are completed it is proposed to put the money back into the undertaking.

In the rural area the position now attained is that twelve main distribution substations have been completed with thirty automatic kiosks and seventy-five pole-mounted transformers. Just over 200 miles of e.h.v. feeders have so far been constructed, with about 250 miles of l.v. line. For the underground feeders 0·15 sq. in. cables are employed, and for overhead lines 0·04 sq. in. In the rural area 4,200 consumers have now been connected out of a potential number of



Bigland Heights splitting station feeding Haverthwaite and Lakeside

8,600. There are another 18,000 consumers in the borough, where only 3,600 premises are still without supplies. Incidentally, it is worth mentioning that, while the rural and most of the urban consumers receive their supplies on the standard 230/400 V AC system, there still remain rather more than 4,000 DC consumers in the borough. These are, however, being gradually changed over and in 1939 a skeleton AC system was provided all over the town so that anyone who desired could have AC without waiting for the general change-over.

Outside the borough there are, apart from farming, surprisingly few industries, but these few are adequately served. They are mainly concerned with slate and limestone quarrying and various industries, many of them peculiar to the district, connected with woodworking, such as bobbin and basket making. Iron ore mining used to be carried on extensively in the district. the hæmatite ore obtained being of very high grade. Many of the mines have been worked out or difficulties have been encountered with flooding, so that to-day only one operates in the district, but this requires some 200 kW.

Electrically operated rotary saw employed at the works of George Barker & Sons for basket making, one of the industries peculiar to the district

The 750 farms in the area are nearly all quite small, most of them not more than 100 acres. Use of electrical appliances, however, is very widespread and since the outbreak of war particularly there have been increasing demands for electrically driven plant for crushing, threshing, milking, sterilising, etc.

A supply is given (in normal times) to anyone who wants one, provided he guarantees 15 per cent. of the computed outlay for five years. Charges for electricity, though slightly higher than in the borough (where electricity is claimed to be the cheapest in Lancashire) are still quite reasonable and have been increased only very slightly since the war began, despite an increase from 16s. to 40s. a ton for coal. The domestic two-part tariff embodies a fixed charge based on the size of the house, ranging from 10s. per quarter for up to 1,000 sq. ft. to 15s. 9d. for 2,000 sq. ft., with 9d. for every additional 200 sq. ft.; the "unit" charge is 1d. for the first 240 kWh and ½d. above. The same "unit" charges, without a fixed charge, apply to heating, cooking, water heating and electric vehicles, while the small power flat rate is 2¾d. for the first 240 kWh, 2¼d. for all over. Lighting costs 6d. for the first 240 kWh, 5d. for the next 240 kWh and 4d. above. The Corporation's published schedule of tariffs also covers large power users and there are no special rates for industrial consumers, or even for bulk supplies. Straightforward though they are, it is proposed to simplify the charges still more after the war, amalgamating some of them and extending the two-part domestic tariff to cover farms.

Although not very popular among rural consumers, prepayment meter supplies, which are available at no higher charge than by quarterly payment, have been chosen by about half of the domestic consumers of the borough. As the meters are set high, there is never any difficulty in obtaining access to the premises to collect the money and return the over-charge to the consumers. Furthermore, although it cannot be considered an advantage in these days of fuel saving, consumers with prepayment meters are found to use considerably more electricity than those paying quarterly.

With the facilities to which we have referred and the additional ones planned, the undertaking should be in an excellent position after the war to provide for the anticipated greatly increased demand for electricity, both from existing and new consumers. We should like to thank Mr. Shepherd for the opportunity of studying his experiences and future plans; and also Mr. J. F. Heslop, mains superintendent, for showing us some of the interesting features of the area.

Metal Processing Bulletins

WE have received from J. V. Rushton (London), Ltd., 173, Clarence Gate Gardens, Glentworth Street, N.W.1, a series of metal processing bulletins which they have issued as a part of a regular service. They include notes on de-scaling ferrous surfaces, acid inhibitors, passivation treatment for zinc plating and zinc base die castings and electro-plating of springs.

Electricity in Aircraft

Need for Joint Study with Designers

THE discussion at the informal meeting of the Institution of Electrical Engineers on February 21st was opened by Mr. C. G. A. Woodford, who emphasised that his views were personal ones and not necessarily those of the Ministry of Aircraft Production, of which he is a technical officer. Commenting on the fact that our aircraft had some leeway to make up in electrical applications he put forward a plea for the electrical engineer and the aircraft designer to work more closely together.

Electronic control devices were destined to play an increasing part in the future, he said. Already automatic pilots, supercharger regulators and other equipment had been introduced and remote control of engines would probably soon appear, effected by compact electronic units.

Types of Generators

As regards power supply, at the beginning of this war most British aircraft had one or two 500-W generators with cooling air passing between inner and outer casing. Corresponding German aircraft had two generators of about the same size but giving 1,500 W each with air blown into the machines. Our heavier aircraft now had three or four generators giving 1,500 W each for armament and general services, and American aircraft now coming into service had seven 5,000-W sets. In this country, 3,000-W generators were coming into use and, like those previously referred to, were of the DC 25/30-V type. The large military aircraft now equipped with DC installations might be regarded as the limiting size for l.v. DC and a change to medium-voltage AC was to be expected. The saving in weight of equipment would be considerable, probably half that of corresponding DC types, and the high degree of reliability would be of greatest importance. Among the technical points referred to were the use of power actuators, assistance by means of power for the pilot to retain the " feel " of his controls of large machines, the Amplidyne generator, supply to essential services in emergency or on the ground, the merits of parallel operation and the necessity or otherwise of constant speed drives.

A tribute was paid to the work of Mr. S. Neville in closely investigating for the M.A.P. the problems of power supply in large aircraft. These investigations, on a calculated basis, confirmed views held both here and in America that the future electrical system for aircraft should be three-phase AC, at a frequency up to 400 c/s. The best voltage to be adopted lay between 100 and 250. While it seemed preferable at present to limit the voltage in military aircraft to 110' with a fully insulated system, there was nothing apparently against the use of double this pressure with earthed neutral in civil aircraft. Standardisation was urgently needed as, in the future, aircraft of British and American design would be used in world-wide service. Greater facilities for testing electrical equipment on aircraft were desirable.

Finally, Mr. Woodford considered the question of how electrical engineers and the electrical industry could best play their parts in aviation. There must be joint study with aircraft designers and the whole problem must be viewed as a special one. In the College of Aeronautical Engineering which was now being planned it was hoped that adequate provision would be made for the specialised teaching of aircraft applications of electricity, electronics, instruments and the new techniques of testing, and that electrical concerns interested in aviation equipment would insist on a proportion of their engineering and design staff going to the college for special courses.

Joint Committee Proposed

In the ensuing discussion emphasis was laid upon the need for a new outlook towards the use of electricity in aircraft. Co-operation between electrical engineers and the aircraft industry was urged throughout and great satisfaction was expressed that the whole subject had been discussed at the Institution. A demand was made for immediate action in conjunction with the Royal Aeronautical Society and it was urged that an approach should be made to that body at once with the object of forming a Joint Committee to explore the possibilities of closer co-operation. The chairman undertook to pursue the matter further.

The use of higher frequency controls was mentioned and it was stated that considerable development was taking place in this direction before the war. In this country neither aircraft manufacturers nor air-line operators had been willing to place machines at the disposal of the instrument makers for testing their instruments as was the case in America. The constant current variable voltage system, used on ships, was suggested as having an application on aircraft. A three-phase delta connected distribution system with one leg of the delta earthed was another suggestion.

Domestic Apparatus—II

Equipment of the Future Home

BETTER houses and better working conditions for the housewife rank high among the country's post-war goals. Neither can be attained without a greater use of electricity, so it is important to ensure not only that adequate provision is made in the design of the houses for the full employment of electricity, but also that suitable electrical apparatus is readily available to meet the new and special requirements. New methods of building construction and changes in ways of living must inevitably have their influence upon both type and quantity of appliances needed.

In the first place, the tremendous leeway that will have to be made up in house building will almost certainly lead to the adoption of pre-fabrication to a very large extent. Even before the war this idea was being increasingly employed for some of the smaller components, *e.g.* doors, window frames, fireplaces, etc., but the developments contemplated represent something much more drastic. It has been suggested that people will be able to buy a house in much the same way as they do a car, from a limited, but not too limited, choice of designs and that a few days will be all the time necessary to erect a complete house. Actually in its recent report on "Methods of Building in the U.S.A." the mission sent by the Ministry of Works to America, favours stressed-skin plywood houses taking only *one* day to erect. These houses have a life of ten years and are composed of two or more sections which, on arrival at the site, are erected on wood staging and bolted together, complete with connections for water, drainage and electricity.

Last week we outlined some of the problems with which the domestic appliance manufacturer will have to cope after the war. In this article we consider possible effects of the design of post-war houses on the production of appliances

Installation Methods

To keep pace with such revolutionary speed of assembly, electrical installation methods must obviously be revised. A standard plumbing system has been devised and it should not be beyond the ingenuity of the electrical industry to find a solution for its own problems. In considering this, however, the estimated life of the installations must be borne in mind. If, as has been proposed, the houses are to be regarded only as a temporary expedient and are intended to last for only, say, ten or a dozen years, there is no point in providing electrical installations which will last fifty years or more. Thus progress awaits a decision regarding the plans and construction of the proposed houses. The demonstration houses which the Ministry of Works is having built at Northolt may afford some guidance.

Perhaps the answer to the problem is to be found in the development of a "harness" similar to but less complicated than that employed in automobiles and aircraft. This could be accommodated in specially designed skirtings, perhaps waist high in kitchens, etc. Alternatively, the skirtings or sectional walls might be supplied ready wired. In either case arrangements would presumably be made for easy access to the wiring for the provision of outlets at any particular position, though if an adequate number of outlets were furnished initially (as they should be) this feature would not often be required. Anyhow, the provision of an additional outlet should certainly not require a major operation on the premises, as it does now.

A ring main system has much to recommend it, but some engineers see no objection to the employment of alternative outlets from the same point, even in different rooms, on the grounds that consumers rarely have two radiators on in the same or adjoining rooms at the same time. Sockets with more than one outlet might certainly be employed to advantage. The cost would be only very little more than for single plug units, and would do away with the unsightly growth of multi-way adaptors so prevalent to-day.

The growing appreciation of the desirability for compact self-contained house service units is apparent from the number of designs brought to our notice recently. By making their exterior appearance neat and attractive, perhaps by the incorporation of a mirror or a clock in the design, the tendency to hide them away from sight in inaccessible corners would be overcome.

Pre-Fabricated Houses

While the word "pre-fabrication" suggests to many the dreary prospect of rows upon rows of uninspiring box-like erections, all precisely the same, there is no reason why this should be so. It should be possible to introduce individuality by means of colouring or slight external differences (as has indeed already been done on some housing estates). What really is essential are standard sizes for rooms or structural units which might be arranged in a variety of different ways.

If the sizes of rooms were standardised,

the design not only of the wiring installations but also the actual appliances to be used in them would be greatly simplified. Most designs for post-war housing envisage a properly planned kitchen with built-in equipment; it is quite impossible to design this until the dimensions of the rooms are known. Standard external dimensions of cookers, refrigerators, etc., to be used for insetting, have, however, now been fixed and will enable the architects and builders to leave the appropriately sized recesses.

Co-operation with Architects

Close co-operation will be desirable with the architects and builders as well as with the housing authorities, who must be further educated in the advantages of making extensive use of electrical appliances. Most of them probably already appreciate the savings that can be effected by eliminating the use of gas altogether, but how many realise that by having only one coal fire (if even this is thought desirable) and consequently not having to build three or four chimney breasts, the saving would be sufficient to pay for all the electrical equipment required, including power points in every room, say, two fixed and one portable fire, a refrigerator, a circulator and the lagging of the hot water system? All these amenities would thus be provided for the consumer without any cost to the housing authority.

This is also an important matter to the builders, who unfortunately in the past have tended to regard the electrical installation as one of the opportunities for economy. Unless there is an adequate provision of outlets full utilisation of the advantages of electricity cannot be achieved, and it is reasonable to believe that if any electrical apparatus at all is installed in any room the wiring should be of sufficient capacity to cater for later apparatus.

Electric Heating Points

The elimination of chimney breasts does not only affect building costs, however. A large amount of floor space is saved, and more still would be saved if the fireplace had not become the essential feature of the room. There is no reason at all why, if electric heating is used, there need be a focal point at all, but if there is, the centre of the room or a window is the more logical place. The anticipated widespread use of television may introduce a complication here. The receiver must obviously become a rival focal point and it will be necessary to place the apparatus with due regard to the heating source.

New materials employed in housing construction will probably affect both the design and efficiency of apparatus. Plastic materials will no doubt find many new applications in apparatus designed to form components of built-in units, as well as for such items as fires, wash-boilers, vacuum cleaners, water-heaters and irons. Besides being easier to keep clean than metal, these materials have the great electrical advantage of being insulators, avoiding the necessity of earthing. The use of heat-insulating materials for walls, etc., would reduce considerably the electric heating consumption.

Returning to the question of built-in apparatus, we have found both supply engineers and manufacturers alive to the advantages of being able to supply complete kitchen units comprising, say, a cooker, refrigerator, wash-boiler or washing machine, water-heater, cupboards, etc. The saving in materials effected by eliminating the necessity for elaborate external case-work is considerable, and with mass production what has hitherto been regarded as entirely a perquisite of the well-to-do may in the long run prove the cheapest way of providing the comprehensive electrical facilities required in the modern kitchen.

For Old or New Kitchens

To produce these kitchen units, both height and depth of apparatus can be standardised without interfering with the manufacturers' scope for technical improvements. By making the various components of the assembly as units it would be possible to fit them into almost any type or shape of kitchen, new or old, and they could be installed individually and added to. The problem of fitting apparatus into another house would also be thus simplified. Since all the apparatus would be the same height, and generally provide a continuous working space, a much greater table area would be available.

By having the cooker hob and oven as separate units the latter could, as often advocated, be raised to a more convenient height. The development of comprehensive kitchen units also raises the question of whether there might not be a use for a combined cooker and water-heater unit, perhaps a version of the thermal-storage cooker, the residual heat from the cooker being employed for heating the water. It has also been suggested that a single motor installed in the unit might, by means of a series of gears, serve not only for the refrigerator, but also for intermittent duty for the washing machine, mixer and built-in vacuum cleaner plant. The complications of the gearing and the low cost of motors do not, however, favour this scheme.

With the separation of oven, etc., into individual units, the question arises whether the saucepan might not develop also into an individual unit with its own heating system, either an element of the type used in kettles or by using the body of the saucepan as part of the short-circuited secondary of

a transformer circuit. Kettles designed to take a small saucepan inside might also fulfil a useful function.

The greater use of built-in equipment both in the kitchen and elsewhere would help to eliminate the main source of annoyance, failure and danger—trailing flex. Where flexibles *have* to be employed, these might be of heavier gauge than those hitherto generally used. This might necessitate the use of larger plugs in some cases, but that again raises other questions.

Space Economy

If electrical appliances are to be used more extensively in the kitchen, accommodation must not only be better arranged, but considerably greater than is customary to-day. An area 10 ft. by 8 ft. has been suggested as the minimum, and this may still be rather on the small side. It is true to say that electrically-operated apparatus nearly always saves space. For instance, an electric water heater takes up much less room than a coke boiler, can be located in any corner, and does not require flues or a fuel store. Again, the installation of a refrigerator makes it possible to reduce the amount of larder space required. A return to bigger kitchens does, however, seem most desirable, unless it is found that changing habits may render some equipment superfluous.

A greater adoption of communal meals, improbable but possible in some districts, might affect the type of cooking equipment installed. Again, if housewives habitually sent their washing to a laundry or if communal laundries were available there would obviously be no need to provide facilities for washing machines or wash-boilers, as well as drying and airing facilities. In such cases the kitchen need not be so large or the equipment so elaborate.

Laundry Requirements

Apart from considerations of kitchen space, cost has been a restrictive factor in the use of domestic laundry equipment. As things are at present, the families which most need the apparatus are those which can least afford to pay for it and those who can afford equipment usually patronise the laundry. There is a big future for washing machines, but until costs can be reduced to make them available to the people who need them most, the larger proportion of householders will have to be content with wash-boilers, which, in any case, unless the washing machines are electrically heated, serve a rather different purpose. It is a point of interest that the use of washing machines has hitherto been confined very largely to the northern part of the country; about three-quarters of the apparatus so far installed is to be found there.

As constant hot water is the service most in demand in the home, there should be a big future for electric water heating equipment. Here again, to ensure most efficient and economical operation, the architect and builder must co-operate with manufacturers, supply undertakings and contractors. Long lengths of piping must be avoided and more attention paid to lagging.

Desirable as the dish-washing machine undoubtedly is, failing some unforeseen development, it will remain beyond the reach of the average home. On the other hand, a promising future is expected for the kitchen mixing machine.

Refrigerators, the value of which was just beginning to be appreciated before the war, will also find a place in many more homes and there are many supporters of plans to make them more freely available. Our different climatic conditions make it improbable that we shall ever arrive at the stage reached in the United States, where a proposed extension of the idea of refrigeration, "deep freezing," will permit the keeping of food *indefinitely* and thus make it possible, for instance, for "fresh" summer fruits to be eaten at Christmas.

Future Lighting

Although we have left until last what is usually regarded as the first use of electricity in the home, lighting may offer the most fruitful opportunities for new ideas. Fluorescent lighting, which is already proving its worth in industry and commerce will eventually find its way into the home. Although the 5-ft. 80-W tube is the only type so far introduced, here units of much more convenient dimensions will ultimately be available. Their low wattage and high efficiency will permit a much more lavish use of electricity, which in any case will be a natural reaction after years of black-out. Although the well-known characteristics of fluorescent lamps now in use may be liked for general utility lighting, for decorative effects warmer coloured lighting will be preferred.

Whether or not fluorescent lighting is available for domestic use in immediate post-war years there will be plenty of opportunity for improvements in lighting. Almost all homes have been under-lighted and there will be a general stepping up of intensities. While lighting is very much a matter of individual taste, there is, we feel, likely to be a continuation of the tendency towards simplicity and efficiency of lighting apparatus. In kitchens, etc., separate lighting for each working surface is the ideal.

In succeeding articles we shall endeavour to foresee the trends that the design of various appliances will take as a result of developments during the war.

Thyratron Regulators

Review of Principal Applications

SOME of the principal applications of thermionic gas-filled triodes and tetrodes, having three or more electrodes and called thyratrons, are summarised while others are described in more detail in a paper by MR. A. J. MADDOCK (Standard Telephones & Cables, Ltd.) submitted to the Wireless Section of the Institution of Electrical Engineers.

Neither the characteristics of these valves nor methods of controlling the passage of current through them are dealt with at any length, but sufficient is said to indicate the lines along which circuit development has already proceeded for their use in four main ways:—(1) As amplification relays, with light-sensitive cells for the measurement of power in lamp loads, switching-on beacon transmitters, power control on occurrence of flash-over; for timing operations, by introducing delays in switching sequences; as a peak voltmeter, over modulation indicator and overload relay; as a frequency meter. (2) As instantaneous switches, for pulse and oscillation generators or single and multiple pulses of square wave form, peaked-pulse generators, relaxation oscillators, as frequency divider or comparator. (3) As current and voltage regulators, or torque amplifiers, for remotely operating timing and position-locating devices. (4) As commutating devices, or rectifiers.

Mercury Vapour Valves

For most of these purposes valves containing mercury vapour are employed because their current and voltage capacities are greater than those of thyratrons filled with inert gases; the latter type are selected when constancy is required without the necessity for temperature control.

The power loss in such valves is small; the larger sizes attain to efficiencies of from 1 to 1·25 A of peak emission per watt of cathode heating power and cathodes rated at 600 A peak emission (100 A average) are in use in the United States. On the Continent valves have been made with a peak emission of 1,000 A, but for practical purposes a limit of 200 A is usual. The maximum peak inverse voltage for normal operation when the valves are designed for large inverse potentials varies from 30 to 15 kV for valves rated at 5 A (150 A peak) emission.

Very small power in the grid circuit suffices to control large power in the anode circuit; a photocell will control even large thyratrons directly without further amplifiers, but in some types a second grid (shield grid) is added to diminish still further the actuating power utilisable. In this way a reduction to less than one-hundredth of the value in a triode may be achieved. At the same time more rapid de-ionisation occurs owing to the closer spacing of the shield-grid to the anode, the former being either connected to the cathode (at zero potential) or having a suitable bias potential applied to it. With such valves a series resistance up to 5 MΩ can be employed in the grid circuit, which is a greater value than can be used with many vacuum valves. In addition, the shield-grid (by reversing the voltage applied to it from positive to negative) may be used to convert a thyratron from a negative to a positive type in respect of control.

Rhodesian Interconnection Plan

IN 1939 the Southern Rhodesian Electricity Supply Commission decided to interconnect its generating stations, where possible, to economise in standby plant in isolated stations. Tenders for 88,000-V transmission equipment to link Gatooma, Umniati and Gwelo were received some weeks after war broke out, but in the prevailing uncertainty the work was not then proceeded with. The Commission's report for the year ended March 31st, 1943, states that subsequent load developments demanded reconsideration and in 1941 orders were placed for this material, construction being begun in 1943. It was necessary temporarily to interconnect Umniati and Gatooma, the latter station possessing inadequate and uneconomical plant originally installed at Bulawayo in 1925. Plans were drawn up in 1941 for additional plant and orders for an initial installation of two 10,000-kW generating units, with boilers and other auxiliary plant, were passed by the British Board of Trade in 1942. When this plant is operating it will be possible to return to Shabani the 3,750-kW unit now at Umniati and allot additional plant to Gwanda.

The central workshops are playing an important part in maintaining electricity supplies by manufacturing equipment otherwise unobtainable, in addition to carrying out the normal work of repairs. Some 700 orders for new equipment, ranging from line construction material to complete power station main switchboards, were completed during the year ended March 31st, 1943. The manufacture of small distribution power transformers is now in hand. The standard of workmanship is claimed to equal that of the best imported article. Specialised equipment such as dies were made for the Department of Supply Production. The test department's activities are expanding and now cover all phases of the Commission's engineering test requirements. Tests, other than on integrating meters, have been undertaken for municipalities, commercial engineering concerns and R.A.F. stations.

Refrigeration Industry

Post-War Prospects and Policy

JUST over a year ago the Commercial Electric Refrigeration Association was reconstituted with a much-widened scope. On February 23rd the new Association celebrated its first anniversary by a luncheon at the Connaught Rooms, attended by a large number of people including leading representatives of Government Departments and of the electrical industry. MR. E. G. BATT, who acts as independent chairman, presided.

The principal speaker was PROFESSOR SIR JACK DRUMMOND, Scientific Adviser to the Ministry of Food. In proposing the toast of the Association, he said that refrigeration was going to be one of the greatest developments after the war. A better general standard of feeding had been achieved during the war and afterwards we must build up that standard.

Badly-handled food lost much of its value. The loss between gathering and marketing was no less than that caused by improper cooking. Food could only be preserved and kept in a more acceptable condition by refrigeration. Two great developments which had not yet been fully exploited were quick freezing and refrigerated transport. People would not keep a sufficient stock of food in hand until domestic refrigeration was in general use.

It was the Association's task to provide the means, whether individual or communal. We were behindhand in the facilities for development, although we were in the van of scientific and technical knowledge, but there were gaps which could be filled only by experimentation. Sir Jack suggested as a future possibility the extension of the system employed for preserving blood plasma by evaporating ice from frozen foods at low temperatures and pressures.

The Association should attach much importance to research, taking both short and long-term views. He considered that instead of reducing research in lean times funds for the purpose should actually be doubled.

Mr. Batt's Speech

In acknowledging the toast, Mr. Batt briefly reviewed the history of the Association and said that with its present membership of 220 it was in a position to give proper consideration to any problems affecting the industry whether they related to manufacture, distribution or service. Cordial relationships had been established with the Government Departments concerned.

Mr. Batt made reference to the reconstruction of industry after the war and said that the Government powers of control should then be employed in an entirely different way. During war the idea was to co-ordinate and achieve maximum production for one customer—the Government, which specified exactly what it wanted. In peacetime industry had to meet a public demand, both home and overseas, representing vastly diversified tastes and requirements.

In some directions control was necessary ; for instance, the home demand might be so overwhelming that manufacturers might neglect export markets, unless allocations of materials were made subject for a time to the condition that a proportion must go into goods for export. Controls would be essential during the transition period but they should be removed as soon as the special conditions disappeared.

Price Agreements

There had been much criticism of price agreements between manufacturers. It was, however, fallacious to argue that all of these must be contrary to the national interest. In his experience such agreements were based substantially on costs of production with all the weight and interests of efficient manufacturers exerted to pull the minimum price down, as against the relatively smaller number of inefficient individuals who wanted to raise them.

As to bulk buying, Mr. Batt thought that if, as had been suggested, bulk buying by Government Departments was to be adopted, any Department so involved should see that the rightful interests of the ordinary distributor and retailer were not encroached upon. The structure of the refrigeration industry was such as to ensure proper distribution and servicing and there was no necessity whatever for any interference or for the setting-up of a duplicate organisation by Government Departments.

There had never been a greater need for exporting manufacturers and merchants to study their job and keep ahead of market requirements. Great Britain must build her export strength on goods which she could make better than others and on new goods which she could be the first to make. British manufacturers must be represented abroad by properly trained and qualified individuals. It was possible that the wartime Export Groups would be of value, particularly to some of the smaller firms with limited resources.

While standardisation was necessary, care should be taken to see that the scope and ingenuity of the designer were not limited in any way. Where it was possible interchangeability of equipment or components should be arranged. In any event the re-

quirements of both the home and export markets should be borne in mind.

The necessary co-operation between the Government and industry could best be achieved through proper trade associations.

The toast of the guests was proposed by MR. R. SEARLE (Kelvinator, Ltd.) and responded to by MR. E. E. HOADLEY (chairman of E.D.A.) who appealed to manufacturers not to be induced to " push " a domestic refrigerator which was too small for its job. Such a course, while it might instil an ambition to require a large refrigerator, might militate against the idea of refrigeration altogether. He promised the whole-hearted support of the electricity supply industry to the Association in its efforts to extend refrigeration in the homes of the people.

Annual Report

In the course of a report covering the activities of the Association during its first year it is stated that the Council has dealt with such matters as rules and constitution, liaison with the Ministry of Works, Essential Work Order, freon supplies, Government bulk buying, rationalisation of service, fair trading code, and form of apprenticeship indenture.

Section A (Machinery Manufacturers) held several meetings during the year. While the scope of the Association is not limited by its constitution, as a preliminary step the section is limiting its deliberations temporarily to land plants up to 10 HP inclusive.

Section B (Insulation Contractors), owing to the wide dispersal of members, has conducted its business by correspondence wherever possible. The work of Section C ((i) Distributors ; (ii) Service Engineers) has been concentrated in a standing committee of which Mr. Walter Riggs is chairman.

It has been arranged with the Inland Revenue authorities that subscriptions will be allowed as " trade expenses " in members' income tax assessments.

A large section of the report deals with the rationalisation of service facilities (for which the Association was largely reconstituted). It was found that, contrary to previous views, the total number of individuals servicing refrigerators was inadequate rather than excessive. Consequently it was reported to the Ministry of Food that it was necessary to protect service personnel to ensure that an essential service was not interrupted. The Ministry adopted a helpful attitude in this matter. Area sub-committees were set up to deal with this matter and petrol allowances.

It was decided to defer application for the scheduling of the industry under the Essential Work Order for the time being, although individual members remain free to make applications.

The Association now receives regular bulk allocations of timber and bitumen for distribution to its makers for essential civilian requirements and bulk allocations of freon and motors for servicing essential commercial plants. The arrangement regarding motors extends to the provision of small " stand-by " stocks for use in an emergency. Negotiations are proceeding regarding bulk allocation of cotton gasket.

Power Station Auxiliaries

Comparison of Supply Methods

AUXILIARY plant in power stations constitutes a large subject and one which has always been controversial. A paper submitted to the London Students' Section of the Institution of Electrical Engineers by MR. G. T. SHEARS attempts to outline the situation and describes some of the problems involved.

It is stated that in 1938 station auxiliaries (statutory only) consumed 1,268,538,333 kWh, reducing the quantity of electricity available for distribution by that amount and entailing an increase in installed plant capacity. Tabulated figures show that 6 per cent. of the total kWh generated by a 60 MW station is needed for the house load; over 90 per cent. of the latter is due to fans and pumps.

The author shows that the case for variable speed motors is strong, explaining why the following types are popular: induction motors with rotor-resistance speed controllers, squirrel-cage induction motors with variable speed coupling, AC commutator motors and the Ward-Leonard system.

Continuous reliability of supply is necessary for auxiliary plant. Driving power derived from transformers connected to the station busbars is not free from mains system disturbances, low voltage, low frequency and surges being the most disagreeable features. House alternators driven by turbines taking bled or feed-heating steam have a limited application, since complications are apt to arise in attempts to integrate small sets with the main heat cycle, while a small replica of the main generating set would be expensive to install and operate. Shaft-driven sets, which are not free from system frequency disturbance, are usually confined to the driving of ancillary plant associated with the main set to which they are coupled. The unit-transformer system, direct connection to the main generator, is silghtly more reliable than shaft-driven sets.

PERSONAL and SOCIAL

News of Men and Women of the Industry

OXFORD University has conferred the honorary M.A. degree upon **Col. H. G. Fraser,** city electrical engineer and manager, Oxford, in recognition of his services to the city and University during the past twelve years.

Mr. J. E. Shepherd, M.I.E.E., whose work in connection with the development of the Barrow-in-Furness rural area is described in this issue, was appointed borough electrical engineer in 1938, succeeding Mr. H. R. Burnett. He was apprenticed to Whipp & Bourne, switchgear manufacturers and contractors of Rochdale, and then joined the Rawtenstall Corporation Electricity Department as an electrical assistant. After serving in the Air Force in 1919 he returned to Rawtenstall as mains superintendent, being appointed borough electrical engineer in 1931. His technical education was received at the Manchester College of Technology, and in 1920 he received the associateship of the College. Mr. Shepherd is at present chairman of E.D.A. (North West England Area), a member of the Council of E.D.A., and a member of the Central Electricity Board's North West England and North Wales Technical Consultative Committee. He is hon. secretary and treasurer of both the Barrow-in-Furness National Savings Committee, and the Barrow-in-Furness Red Cross Penny-a-Week Fund Committee.

Mr. J. E. Shepherd

After five years as district manager at Bridgnorth for the Staffordshire, Worcestershire and Shropshire Electric Power Co., **Mr. F. G. Haddon** has gone to Smethwick in a similar position, and is succeeded by **Mr. E. C. Eades,** of Church Stretton.

Alderman W. Walker having been elected to the chairmanship of Manchester Corporation Electricity Committee in succession to the late Councillor Hilder Strange, the vacant position of deputy chairman has been filled by the election of **Councillor H. M. Emery.**

Mr. J. Henderson, M.C., B.Sc., M.I.E.E., who has been the Central Electricity Board's technical engineer for Scotland for the past sixteen years, will shortly take up an appointment as deputy engineer and manager of the Ayrshire Electricity Board. Mr. Henderson was born at Dunning, Perthshire, in 1894, and was educated at the Perth Academy and the Stirling High School, taking an engineering course at the Royal Technical College, Glasgow. From 1915 till 1919 he held a commission in the Argyll and Sutherland Highlanders and the Royal Tank Corps and after the war he was for five and four years respectively with the Electricity Departments of the Glasgow and Edinburgh Corporations. Mr. Henderson's service with the Central Electricity Board, which he joined in 1928, covered the period of the construction of the grid in Scotland and he was responsible, under the district manager, for carrying through the large frequency change programme required under the scheme for the Central Scotland Area.

Col. H. Carter, T.D., Deputy Regional Director, Scottish Region, G.P.O., has been nominated as chairman of the Scottish Centre of the Institution of Electrical Engineers for 1944-45.

Mr. R. I. Kinnear, electrical engineer, John Brown & Co., and **Mr. P. Philip,** city electrical engineer, Dundee, have been nominated as vice-chairmen.

Mr. J. A. Harle has been nominated by the committee of the I.E.E. North-Eastern Centre as chairman for next session, with **Mr. T. R. Warren** and **Mr. W. Dixon** as vice-chairmen.

On behalf of the staff of the Oldham Corporation Electricity Department, Mr. R. G. Whitehead, joint chief engineer, last week handed a gold watch to **Mr. A. A. Wallworth,** who has just retired from the position of chief commercial assistant. His successor is **Mr. F. Sharpe.**

Sir William Palmer has been released from his position in the Ministry of Production, to take up the post of principal industrial adviser to the Board of Trade. In this capacity he will be specially concerned with major matters of reconstruction policy in connection with the engineering and other industries at present engaged mainly in the production of war materials.

Reference to the institution of a staff pension scheme, for the first time in the 63 years' history of the organisation, was made by Mr. Thomas Atherton, Companion I.E.E., managing director, when he spoke at a dinner given by the directors of Dorman & Smith, Ltd., to their staff at the Midland Hotel, Manchester, on February 25th. He said that in the past various difficulties had militated against the launching of such a project. Besides Mr. Atherton, other directors present were Major R. Amberton, M.I.E.E., Mr. J. Noel Haworth, A.C.A., with their wives, and Mr. Bruce L. Cooper. A presentation of a gold watch was made by Mr. Atherton to Mr. Arthur Whitehead, who is in his fiftieth year with the firm. Three years ago a brother, Mr. E. J. Whitehead, was similarly presented, also for fifty years' service. After making the presentation, Mr. Atherton referred to post-war difficulties, and concluded by saying that much hard work would be necessary if order was to be retrieved from chaos in the post-war era. Miss B. Nall, an employee of 30 years' service, then presented Mrs. Atherton with a silver trinket box.

The question "Would civilisation collapse without electricity?" was quickly disposed of by **Mr. R. A. McCulloch,** engineer and manager of the Salisbury Electric Light & Supply Co., Ltd., when he addressed a gathering of young people at the Guildhall recently. It would, he said, and the universe as well. Answering the question as applying to the public service

operated by his company, he drew a picture of what the city would be like if the supply were suddenly cut off. Fortunately, as Mr. McCulloch pointed out, the availability of alternative supplies made this possibility remote.

Mr. Frank Forrest, having retired from the position of city electrical engineer of Birmingham, has ceased to be a member of the Council of the Incorporated Municipal Electrical Association. The *I.M.E.A. Journal* says that this is a matter for extreme regret, as Mr. Forrest during his service on the Council and as president in 1936-37 has rendered valuable assistance in many matters of importance.

Mr. R. Birt, borough electrical engineer of Ealing, has been appointed an additional member representing the I.M.E.A. on the Council of the Electrical Research Association.

Lieut.-Col. C. Hardie, D.S.O., general manager of the Chelmsford works of Crompton Parkinson, Ltd., since 1928 and an executive director of the company since 1939, retired last week. Before joining Crompton Parkinson he held appointments with Dick, Kerr & Co., Ltd., and with its successor, the English Electric Co., Ltd. He was entertained to dinner by his colleagues last week, Mr. T. H. Windibank presiding. On behalf of the staff and workers Mr. H. C. Burge presented him with a George III silver coffee pot made in 1777 by the silversmith John Schofield.

Mr. F. C. Mannox has been appointed managing director and **Mr. H. C. Green** general manager of Murex, Ltd.

Obituary

Mr. W. C. Lusk.—We learn with regret of the death on February 25th, following an operation, of Mr. William Clardy Lusk, chairman of the British Thomson-Houston Co., Ltd., and deputy-chairman and managing director of Associated Electrical Industries, Ltd. Mr. Lusk, who was sixty-eight years of age, was born in the United States and was educated at Yale University, taking a B.Sc. degree. He joined the American General Electric Co. and went to India for that company in 1901. Later he joined the London staff of the company and became manager. His connection with the B.T.H. Co. began in 1910 when he was appointed manager of the export department, becoming managing director in 1922. He became a naturalised British citizen in 1938.

Mr. Lusk was also on the boards of the Metropolitan-Vickers Electrical Co., Ltd., the Power Securities Corporation, Ltd., and the Lancashire Electric Light & Power Co. Cremation was to take place at Golders Green yesterday (Thursday).

A memorial service is to be held on Wednesday next, March 8th (11.45 a.m.), at St. Michael's, Cornhill, London, E.C.

Dr. L. H. Baekeland.—The death occurred in New York on February 23rd of Dr. Leo Hendrik Baekeland, whose name was familiar as a pioneer in the production of plastic materials. Dr. Baekeland was born in Ghent in 1863 and was educated at the University of that city, gaining a doctorate in science. He went to the United States, where he set up a company to manufacture photographic printing papers of his own invention. He became president of the Bakelite Corporation in 1910. Dr. Baekeland's work was recognised by many American and European universities and scientific societies.

Mr. G. J. Berry.—As we mentioned in last week's issue of the *Electrical Review*, the funeral of Mr. G. J. Berry, chairman and managing director of Berry's Electric, Ltd., took place quietly at Putney Vale Cemetery: a simple but impressive service was held in St. Paul's Church, Wimbledon, and besides members of the family, directors of Berry's Electric, Ltd., and representatives of the staff, a number of personal friends in the electrical industry attended. These included Messrs. A. E. McKenzie, A. E. Iliffe and E. K. Muir. The industry has lost one of its most pleasant and sincere personalities in Mr. "Tim" Berry, and his staff have lost a good friend.

The late Mr. G. J. Berry

We offer our deepest condolences to Mrs. G. J. Berry and to his mother, Mrs. A. E. Berry and family. We understand that although Mrs. G. J. Berry, who was also injured at the time of her husband's death, is progressing, this is somewhat retarded we regret to add by the fact that her daughter Jacqueline, who was also injured, has had to have her leg amputated.

Mrs. A. Dick.—We regret to hear that Mrs. Annetta Dick, wife of Mr. J. R. Dick, chairman and managing director of W. Lucy & Co., Ltd., died at Reading on February 21st in her seventieth year.

Feed-Water Treatment

POTASSIUM salts have been tried instead of sodium salts for treating feed water in generating stations in the United States, *Power* reports, with successful results. At the Springdale station of the Penn Power Co., which had had some boiler scaling and serious turbine-blade depositions with its 1,350 lb. per sq. in. superposed unit, the first results of a change to potassium were leaks at rolled end tubes and gaskets owing to the dissolution of existing scale formations, but the silica content of the boiler was reduced from 13 to 2 per cent. and the scale was loose and soft. Interior surfaces now show a light grey deposit, which is readily washed off, and no evidence of sludging. The treatment has been extended to 350 lb. per sq. in. boilers, in the upper banks of which, where circulating is sluggish and the tubes have not been turbined, scale has been formed.

At the Windsor station of the American Gas & Electric Co. sludge deposits, sodium-aluminium silicate scale on boiler tubes and turbine-blade deposits have been found on high-pressure units. Change to potassium treatment removed previously formed silica scale without tube or gasket leaks. Intervals between washing low-pressure turbines have been considerably reduced. It is expected that boiler scaling will soon cease to be a problem at this station.

CORRESPONDENCE

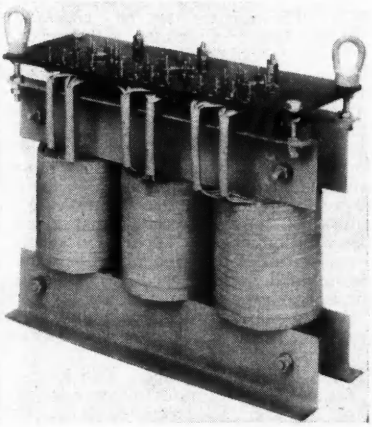
Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Transformer Transport in Wartime

THE description of a trailer for the transport of very large power transformers, which appeared in the *Electrical Review* of February 18th, prompts me to comment generally on transformer transport and to point out difficulties which have arisen as a result of wartime conditions.

Not much imagination is needed to appreciate the difficulty of handling transformers weighing 50 to 100 tons, and steps have been taken in the past by the railway companies and others to deal with this problem. The carriage of intermediate oil-immersed power transformers up to about 5,000 kVA size does not present any particular difficulty as ordinary transport facilities are satisfactory. Packing or crating is unnecessary except for shipment overseas. Instrument and radio transformers must be packed, but this, apart from present difficulties in obtaining suitable cases or timber, does not introduce any problems.

When arranging transport of the remaining class of transformers, namely from about 1 to 50 kVA of the air-cooled type (similar to that illustrated), and choke coils of the same dimensions, very great difficulties are experienced by the manufacturer. In normal times these are not generally required in large numbers, but at present they are being produced in quantities of hundreds and thousands at a time. In peacetime any road transport contractor is prepared to reserve floor space in a vehicle for such transformers and to deliver direct to the destination. The manufacturer can then see them safely loaded and depend upon their arrival undamaged.



A difficult-to-transport transformer

Present conditions make difficult the reservation of floor space in this way or direct delivery without transhipment, and it has been laid down by the Ministry of War Transport that such goods must be packed. This involves the use of large quantities of timber and the expenditure of a considerable amount of labour, for a transformer weighing, say, 3 cwt. requires a robust case. If more than one unit is packed in a case each must be securely held in position by battens. Packing material such as woodwool cannot be used as it would be crushed and would afford no reliable protection.

It is perhaps not appreciated fully that an air-cooled transformer is among the heaviest articles for its volume that the transport contractor is called upon to handle. In general, cases or crates must be made specially in order to avoid the wastage of space which invariably occurs with the use of existing cases. The manufacturer is thus called upon to provide factory space and labour for an operation which is not necessary in peacetime. It can readily be appreciated that delays in getting the goods out of the factory are bound to occur, and congestion in the production departments results.

It is felt that this is a matter in which the Ministry of War Transport should relax its regulations somewhat. Other readers' opinions would be of interest, as there may be other electrical machinery the transport of which presents similar difficulties.

Ponders End, Middlesex.

R. C. HENNIKER, B.Sc.(Eng.), A.M.I.E.E.
Manager,
British Power Transformer Co., Ltd.

"Only Lighting?"

THE point of view raised by Mr. Purse in his timely letter published in the *Electrical Review* of February 18th has engaged my interest for some time. I have not made up my mind, however, as to the best method of allowing gas interests to learn that they are losing the domestic fuel battle, a fact which apparently no one in the gas industry will acknowledge.

An attempt to adopt the bold plan advocated by Mr. Purse will raise a most formidable wall of opposition, not only from the gas interests, but also from certain mis-

guided people in authority who will advocate "free choice." Certainly his scheme will avoid waste of capital expenditure.

On the other hand, if gas interests use relatively large amounts of capital completely disproportionate to the revenue obtainable, there must inevitably follow increases in prices, and the slippery slope of "diminishing returns" might do more to achieve Mr. Purse's aim than the direct method. The men who run the gas industry will surely be sane enough to see soon that competition is impossible and will desist in useless waste of capital.

Perhaps the following comparisons are not without point in this discussion. They relate to the year 1943 which, in this instance, is typical. The houses are scattered along 700 yd. of a road which will be built up when building is again permitted. Here it should be stated that there has been no change in consumer data since 1939. The road is on the fringe of a small industrial town where the local authority owns both electricity and gas undertakings. The former erected overhead lines in 1935 and gas mains were laid about the same time. The majority of the houses were built before electricity and gas were available. Simple hire and hire-purchase schemes were available from January, 1937, the Council taking great care that no undue favour should be shown to either undertaking. These are the comparisons :—

	Electricity	*Gas*
No. of houses	23	23
No. of consumers	23	7
Total revenue	£233	£49
Average revenue per consumer	£10·13	£7
Average per house	£10·13	£2·13

The electricity mains could easily have supplied both demands without increase in cost and I will leave readers to calculate the respective returns on capital expenditure, which must vary according to circumstances, but with the certainty that the costs of gas mains and services must nearly always be the greater.

"ADVANCE ELECTRICITY."

Testing AC Motors

IN the method described by Mr. G. Dawson in your issue of February 18th for calculating motor slip by using a millivoltmeter to obtain the cycles of the rotor, the meter should preferably by a DC one having a central zero. Also, the rotor starter must be in the full-on position with the brushes "shorted" before the meter is connected to the slip rings; otherwise it will be damaged due to the rotor volts.

The basic formula used in this calculation is:—Slip in RPM =

$$\frac{\text{synchronous speed of motor} \times \text{cycles of rotor.}}{\text{cycles of stator}}$$

f this is developed on the basis of the ime taken for the actual rotor cycles to equal the slip in RPM, then (assuming a 50-cycle supply), with a motor synchronous speed of 3,000 RPM, the slip in RPM equals beats or cycles in 60 seconds and is *pro rata* for lower speeds. All that is necessary is to count the beats over the given time in order to obtain the slip in RPM. One disadvantage of the method is that if the slip of the motor is high, the beats per second are so great that it is very difficult, if not impossible, to count them.

The simplified method of calculation used in my article is basically identical with the recognised B.S.S. method and will give exactly the same results for the same figures that Mr. Werninck's method gives. If the figures are worked out strictly to B.S.S. 269-1927, that is, taking into account stray losses, and with the resistance calculated for 75 deg. C, the comparative results are as follows :— Using cold resistance at 15 deg. C, with no stray losses, the efficiency = 85·5 per cent. and HP = 4·1 (as calculated in my article); using hot resistance at 75 deg. C, and with stray losses, the efficiency = 83·4 per cent. and HP = 4·02.

This is the worst case, and the slight error involved does not warrant the extra calculation, as a reasonably accurate load test is all that is required. In any case, meter inaccuracies could account for differences as high as the above.

Leicester. K. BROOM.

Electricity Supply Reorganisation

THERE appears to be considerable divergence of opinion with regard to the proposals for the reorganisation of the distribution side of the electricity supply industry; in fact, with the exception of proposed slight adjustments and modifications the position appears to be a desire to maintain the *status quo*. I venture to put forward for constructive criticism proposals which, in my opinion, appear to be the only reasonable and equitable solution to the problem. It is appreciated that although these proposals are apparently simple a great deal of clarification would be required before finality was reached. My suggestions for reorganisation are as follows:—

A Regional Board to own and control the whole of the distribution within its area. The Board to consist of—

(*a*) Five paid members who have professional qualifications either engineering or financial, and recruited from within the industry.

(*b*) Five members representing local authority interests, *i.e.*, town and county councils, etc. These members would receive expenses and a fee for each meeting attended.

(*c*) A paid chairman, preferably with engineering or financial knowledge, to

be appointed by the Electricity Commissioners, subject to the approval of the Regional Board.

(*d*) A secretary with the necessary staff.

Initially, the financial side of each undertaking in the area would be transferred from local authority or company control to the Board. Engineering and technical matters would continue to be dealt with by the existing local organisations with consultative control from the Board. Progressively the local undertakings would either be amalgamated or sectionalised into economic units according to the form of organisation set up by the Board.

Finally, the Board would appoint a central administrative and technical staff to co-ordinate and control local undertakings. The Regional Board would be responsible to the Electricity Commissioners, and regional areas would be of a geographical and economic nature and determined by the Electricity Commissioners. Experienced members of the Regional Boards would be promoted to the Electricity Commission when positions became vacant.

"UNBIASED."

IN reply to "Common Sense" in your issue of February 18th, he is right in assuming that I intended to advocate *uniformity* of tariffs. Large undertakings can more easily improve their own diversity and load factors, thus bringing down the price per kWh to the buyer, because they have more loads of different types and can encourage the type required. Taking into account chances of development, my view is that an undertaking selling fewer than ten million kWh per annum should be merged with a bigger neighbour. I am in agreement with clause 49 of the Memorandum, as I contend that having more engineers on a committee will get better results. By "more electrical brains," I mean "more electrical engineers and fewer butchers, bakers, etc."

"SAFEGUARD."

Supply Industry and Research

IN the Memorandum of the Electric Power Companies' Association, great play is made with the achievements of the company side of the electricity supply industry, particularly the high code of obligations towards employees, the expenses of the Electricity Commissioners, and several similar matters, but no reference is made to research.

The joint report of the I.M.E.A. and various companies not associated with the former report does refer to the Electrical Research Association, but in a rather meagre way. The latter report quotes the number of public authorities as 337 with a capital expenditure of £330,000,000, and the companies as numbering 214 with a capital expenditure of £223,000,000.

When we come, however, to examine the twenty-third annual report of the Electrical Research Association, we find that the total income for the past year was only the paltry sum of £111,000, and on turning to the list of members who are authorised undertakers, we find that there are only 182 municipalities subscribing £20,000, and 63 companies (28 being grouped under two holding companies) subscribing £9,849, the majority of the London electricity supply companies being conspicuous by their absence.

The joint report does suggest a compulsory contribution to the Electrical Development Association, but neither report suggests the desirability or willingness of all undertakings supporting the Electrical Research Association in a manner befitting its place in the industry.

"INTERESTED."

New Zealand's Imports

Decrease During 1942

ACCORDING to returns of New Zealand's overseas trade for 1942, published in Wellington, the Dominion's total imports of electrical goods were valued at £N.Z.1,941,000, a decline of £226,000 on the previous year. The main items are shown in the accompanying table, with a note of increase or decrease compared with 1941. The only noteworthy advances were in telegraph, telephone and radio goods.

Class	1942 (£N.Z.)	Inc. or dec. on 1941 (£N.Z.)
Storage batteries	13,100	+ 2,800
Parts of storage batteries	19,500	= 15,900
Other batteries, and cells	7,800	− 1,400
Carbons for arc lamps, etc.	6,500	+ 2,700
Cooking ranges	2,400	− 13,300
Heating and other cooking appliances	11,200	− 17,500
Unspecified electrical appliances	14,900	− 12,600
Electrodes for arc lamps, etc.	38,300	+ 19,300
Insulated cable and wire	363,700	− 118,800
Insulating materials, unspecified	49,500	− 1,900
Filament lamp bulbs	85,400	− 4,300
Electric lamps, unspecified, other than surgical	20,900	− 16,900
Motors and parts	232,800	+ 10,600
Radio receiving sets	800	− 700
Radio valves	89,200	− 15,200
Other radio goods	175,300	+ 65,000
Telegraph and telephone apparatus, not radio	70,900	+ 20,400
Electric irons	700	− 1,200
Insulators	4,200	− 2,800
Other electrical apparatus	730,800	− 93,800

Full particulars of the supplying countries are not available but there is reason to believe that Great Britain has remained by far the largest participant, with the United States next and Australia not far behind. Canada has had a fair share of the radio trade and has done more business in the matter of cables than has the United States.

Discharges in Dielectrics

Observation and Analysis

HOW discharges taking place internally within dielectrics, for instance inside power cables and radio condensers, may be observed and analysed is described in a paper by Dr. A. E. W. Austen and Miss W. Hackett, Ph.D., submitted to the Institution of Electrical Engineers in London on behalf of the British Electrical and Allied Industries Research Association.

Methods of observation previously employed are reviewed briefly; while each of them undoubtedly permits quantitative comparison of different test specimens, no attempt at absolute interpretation of the observed results appears to have been made, apparently because of incomplete appreciation of the nature of the fundamental phenomenon. The authors accordingly define their own view, some of their evidence in support of it being recorded in this paper. They state that the partial breakdown, which may afford evidence of incipient failure, consists basically of the appearance at the terminals of the test capacitor of a sudden change of voltage of the form of a unit function.

Choice of Methods

They then describe several methods of observation, the choice depending upon whether information is required about the threshold voltages for discharges, or their number or magnitude. The high-frequency discharge detector when used with a tuned input circuit appears to be more sensitive than the other six methods. While the oscillographic bridge is about ten times less sensitive as used for one discharge per half cycle, it is adequate for many purposes (in any case the amplification can be increased) and has the additional advantage of better discrimination of discharges to earth and extraneous interference. But the greater complication of equipment renders it less convenient than high-frequency detectors for routine testing.

There is ample evidence that power factor (even in the absence of other causes of power factor increase) is considerably less sensitive as a means of discharge detection than the special electrical methods and, moreover, the assumption that gaseous ionisation is the only cause of phase angle growth (in cables for instance) has been questioned, it being recognised that dielectrics are apt to fail from causes other than the generation of heat.

Visual detection is probably rather more sensitive than aural, both probably being comparable in sensitivity to the power factor method. Visual detection may be convenient for external discharges, or internal discharges in transparent and translucent dielectrics when economy of apparatus is important, but this method requires considerable care. Aural detection is likely to be useful for such specialised purposes as the location of discharges in long lengths of cable.

High-speed Recurrence

Measurement is not troublesome when discharges occur relatively infrequently, at or near the starting voltage, but difficulty is encountered when recurrence intervals approach 50 μs, being less than the time needed for the response of the measuring device to become small. Thus in cases in which external discharges are absent the oscillograph bridge method is simpler, and its rather smaller sensitivity has not been a serious disadvantage.

Most of the phenomena observed in mainly solid insulants are consistent with the hypothesis that they are due to the breakdown of gas in holes in the dielectric substance. The predicted behaviour is compared with experimental observations and leads to calculation of energy loss at power frequency, which the authors compare with the measured value in a simple case. The detailed mode of gas discharge is of great complexity, the conditions of intermittent discharge varying in a complicated manner with discharge and extinction voltages. In general with AC the energy drawn from the source of supply after a particular discharge is not equal to the amount dissipated in that particular discharge, but over a number of cycles the total amounts are equal.

Variation of Power Factor

It appears that the energy loss at power frequency is approximately proportional to the difference between the applied voltage and that at which discharges begin, there being a corresponding variation of overall power factor. In some cases discharges have been observed at voltages as low as 290 V crest, which is difficult to explain because that value is below the minimum breakdown voltage for air. It is therefore possible that some function other than gas discharge is operative in such instances.

After outlining the application of the methods described to the testing of radio condensers and paper-insulated power cables, the authors conclude that they have established the validity of discharge detection methods, in that they permit observation of a specific phenomenon, which is defined.

COMMERCE and INDUSTRY

E.T.U. Wage Claim. Coal Increase Question.

Battersea Polytechnic's Jubilee

KING Edward VII (as Prince of Wales) opened the Battersea Polytechnic on February 24th, 1894 ; thus the institution's jubilee occurred last week and a small luncheon was held to celebrate the occasion. A message of congratulation was received from the Princess Royal, the Polytechnic's patroness, and the speakers included Canon H. Curtis, who was chairman for about thirty-three years, Sir Harry Selley, M.P., Mr. F. C. R. Douglas, M.P. (chairman of the L.C.C.) and Sir Robert Pickard, former acting principal.

Electricians' Wages

Last year members of the Electrical Trades Union employed in the electrical contracting industry applied for a wage increase of 3d. an hour. The employers rejected this application and the matter went to arbitration. The arbitrator awarded an advance of ½d. an hour to men in grades B, B2 and C, but nothing to those in Grade A, comprising the London district. Dissatisfaction with the award was expressed and the National Executive Committee of the E.T.U. was asked to take steps to secure the amendment of the award in line with the claim of 3d. an hour increase. The matter was taken a stage further on February 21st when a national delegate conference of the E.T.U. held in London decided that an immediate application for an increase in electricians' wages should be made.

The *Electrical Trades Journal* (the official organ of the E.T.U.) states that two adjustments have been made in the agreements operating with the Electrical Contractors' Association of Scotland. The first increases, as from December 31st, 1943, the outworking allowance to 24s. 6d. per week ; on jobs of short duration the allowance will be 5s. per day for the first four days and 3s. 6d. per day thereafter. The employers offered an increase of ½d. per hour in rates. This has been accepted, raising the standard national rate in Scotland to 2s. per hour, as from January 1st, 1944.

Cost of Open-Cast Coal

The committee representative of power station owners in the Mid-East England Area has passed a resolution protesting strongly against the increase of 3s. a ton in price of mined coal being applied to open-cast fuel. This was reported to Hull Electricity Committee at its last meeting when a resolution supporting the attitude of the area committee was passed and it was decided to place the facts before the local M.P.s with a view to the matter being raised in the House of Commons.

Mr. D. Bellamy, the general manager, stated that the increase in the price of all classes of coal would cost the Hull undertaking £27,000 a year. An additional charge of 4s. 6d. a ton for open-cast coal, if conceded, would entail an annual extra cost of £4,622. He said it was felt that there should be a disclosure of the cost of open-cast coal, which was being obtained by public works contractors. Undertakings had done their utmost to relieve the mined-coal situation by utilising open-cast fuel in spite of its variable quality and the extra expense entailed in transport and handling. Members of the area committee, he said, had agreed to withhold payment of any advance on the price of such coal because it was felt that the reasons given by the Minister of Fuel and Power for the recent increase in the price of mined coal did not apply to open-cast fuel.

Mr. Bellamy further stated that the Electricity Department used large quantities of coke breeze and that the Government in its authorisation was reported to have granted an automatic increase of 1s. 6d. in the price per ton. They bought their supplies in a free market, and he had written to the Minister of Fuel and Power asking him not to interfere in this matter, otherwise there should be rationalisation of distribution within geographical limits to eliminate unnecessarily long hauls. The additional cost to Hull of this increase in the price of coke breeze, if sanctioned, would be £3,302 a year.

Boy's Death in Shelter

In the King's Bench Division last week Mr. W. H. A. Walder brought an action against Hammersmith Borough Council for damages for the death of his son, Leonard Stanley Walder, aged eleven, owing to alleged negligence on the part of the Council.

It was stated that on January 19th, 1943, shortly after two air raids, the gate on a fence round a shelter at Shepherd's Bush Green was left open. The boy went into the shelter and with a pair of clippers was endeavouring to cut through an electric wire on the ground when he received a fatal electric shock. Plaintiff claimed that the leaving of the shelter gate open in a place where children were accustomed to play was an allurement to them. For the Council it was stated that 49 shelters needed repairing after the raids and there had not been time to finish all the work when the accident happened. It was submitted by the Council that the boy was a trespasser.

His Lordship gave judgment for the Council, saying that he was quite satisfied, on the evidence, that defendants had not been in the least degree negligent in the steps which they had taken to prevent children from trespassing in the shelter, which was clearly private and enclosed property.

Damages for Injury

Damages amounting to £2,125 were awarded at Durham Assizes to Samuel C. Wheatley (42), electrician, in an action against the Consett Iron Co., Ltd. Liability was admitted. It was stated that on January 4th last year plaintiff slipped and fell and his right hand was caught in unfenced machinery with the result that three fingers had to be amputated. He returned to work on September 27th and did odd electrical jobs. His average weekly earnings before the accident were £7 19 3d. including

overtime. His employers had since paid him the same wage of £5 14s. 9d. but he had not been able to earn overtime.

Motor Data

It is announced that Brook Motors, Ltd., Empress Works, Huddersfield, have arranged to publish at the price of 1s. 6d. a new edition of the very useful booklet (No. 500c) entitled "Installation and Maintenance of AC Motors," which is of vest pocket size and illustrated with many clear diagrams. Its contents have been very considerably augmented to more than 200 pages and, although naturally referring to the company's own products in particular, the practical advice and technical data it contains are equally applicable to almost any make of motor. A useful chapter on maintenance has been added and at the end of the booklet are tabulated the various voltages and frequencies of supply of most authorities distributing electricity in the British Isles.

Recovering Metal from the Thames

During the demolition of Rennie's old bridge, the construction of the new bridge and the dismantling of the temporary steel bridge at Waterloo it was inevitable that numerous

Lifting-magnet with metal salvaged in first experimental sweep

tools such as hammers, spanners, crowbars and augers were inadvertently dropped into the Thames, together with a considerable amount of material forming part of the bridge structures, such as nuts, bolts, steel plates, channels and steel slings. Under present conditions the recovery of such material by a quick and efficient method is extremely desirable and to this end a watertight Witton Kramer lifting magnet of 26 in. diameter (2 kW, 220 V, DC) was brought into use by the contractors, Peter Lind & Co., Ltd., in collaboration with the General Electric Co., Ltd. The first sweeps in the Thames were carried out with the magnet suspended from the hook of a travelling jib crane situated on the roadway of the new Waterloo Bridge and the results obtained were extremely satisfactory; a substantial quantity of long and short bolts, hammers, steel augers and similar usable material was reclaimed. It is expected that, with the magnet gear installed on a suitable craft to enable systematic searching to be made from the bed of the Thames, a large amount of such valuable material will be reclaimed in a speedy and economical manner.

Gauge and Tool Makers

The Gauge and Tool Makers Association has published a new edition of its members' handbook containing details of the Association's objects, present officers, Council and committees, and an alphabetical list of the member firms, now numbering more than a hundred, together with their acredited representatives. Copies of the handbook are available from the secretary, Mr. G. T. Beach, Standbrook House, Old Bond Street, London, W.1.

Motor Manufacture in Mexico

Reuter reports that the American Sterling Electric Motors Co. announces its intention of establishing a large factory in Mexico for the manufacture of electric motors for Mexican and South American markets. It has asked for special concessions from the Mexican Government for the construction of the factory.

Engineering Cadetships

The Ministry of Labour and National Service announces that a further number of engineering cadetships, preparatory to technical commissions in the Forces, are to be granted this year. Candidates must have been born between July 1st, 1926, and June 30th, 1927, and the last day for the receipt of applications is March 31st. Forms of application can be obtained from the Ministry at Alexandra House, Kingsway, W.C.2.

J. Dyson & Co.

In our last issue we reported the registration of J. Dyson & Co. (1944), Ltd., to take over the business of J. Dyson & Co., Ltd. (in liquidation). We are asked to state that this liquidation is a members' voluntary winding-up. The business is being continued at 111, Thornton Road, Bradford.

Ex-Service Equipment

In the course of some comments in its November, 1943, issue, the American magazine *Radio*, says: "We understand that radio equipment now in use by the armed forces will be thrown into the civilian market after the war. If this is true, then many of the smaller radio manufacturers may find it extremely difficult to keep their heads above water. If not directly usable such equipment could be readily converted for use by amateurs and numerous commercial and municipal radio systems and thereby wipe out a

sizeable market for new equipment upon which the small manufacturer must rely.

"Unquestionably something will have to be done with the surplus equipment on Government hands at the end of the war—but isn't there a possibility that it could be converted by U.S. manufacturers for subsequent sale in foreign countries where communication equipment will be in immediate demand? Until foreign countries can get back into production it would seem more logical to sell them our surplus equipment rather than to disrupt the domestic market by dumping the equipment here."

Welding Aluminium

The welding of wrought aluminium and alloy castings is dealt with in a leaflet (M.18) issued by Murex Welding Processes, Ltd., Waltham Cross, Herts, which points out that the principal advantages of the metallic arc process for this particular kind of work are greater speed and reduced distortion. The heat-affected zone immediately adjacent to the weld is highly susceptible to corrosion, and the arc process has the important advantage of localising this zone to narrow dimensions. The pamphlet deals with types of electrodes available for DC and their storage, as well as the preparation of work and its preheating when advisable on account of size or complexity.

Trade Announcement

The Rheostatic Co., Ltd., Slough, Bucks, has opened an office and showroom at 43, King Street, Manchester (telephone, Blackfriars 8526). Mr. S. G. Ward, who has been resident engineer for the company in the area for a number of years, working from his private address at Wilmslow, is in charge of the new office.

Los Angeles Plant Taken Over

Reuter reports that President Roosevelt has ordered Mr. H. L. Stimson, Secretary of State for War, to take over and operate the Los Angeles Municipal Water and Power Company. A strike of the company's employees resulted, it is stated, in 125,000 homes being without electricity.

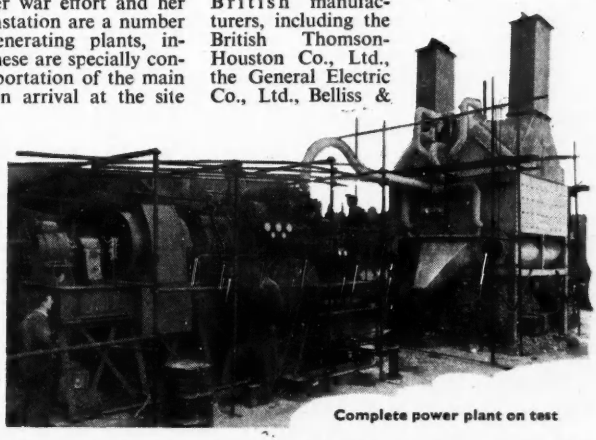
Generating Plants for Russia

Special Construction for Rapid Installation

AMONG the large quantity of electrical equipment which has been or is being made in this country for dispatch to Russia as an aid to her war effort and her recovery from war devastation are a number of complete steam generating plants, including the boilers. These are specially constructed for bulk transportation of the main components, so that on arrival at the site where they are required to operate all that is necessary is to place each of them on suitable foundations and make the necessary steam and water couplings and the cable connections. The main components of each plant are the drum and tube boiler assembly, the boiler furnace, the boiler auxiliaries, the self-contained turbo-alternator set, complete with its condenser and auxiliaries, a step-up transformer, together with a switchboard.

All the boilers are being supplied by Mitchell Engineering, Ltd., and are designed for the consumption of low-grade fuel. Each will deliver 8,500 lb. of steam at 221 lb. per sq. in. and 536 deg. F, superheat, when supplied with feed water at 100 deg. F., and in addition saturated steam for the boiler feed pump. Arrangements are also provided for the supply of 2,000 lb. per hr. of saturated steam for process and heating purposes.

The turbo-alternators are of the "transportable" type and are being supplied, wholly, or in part, by several well-known British manufacturers, including the British Thomson-Houston Co., Ltd., the General Electric Co., Ltd., Belliss & Morcom, Ltd., Hick, Hargreaves & Co., Ltd., Bruce Peebles & Co., Ltd., Lancashire Dynamo & Crypto, Ltd., and Mather & Platt, Ltd. They all have the same steam and electrical conditions, namely, 220 lb. per sq. in., and 400/230 V, three-phase, 50 cycles, 0·8 power factor, and the various sets differ only in rating and construction.



Complete power plant on test

The complete plants will be described in detail in a later issue of the *Electrical Review*.

Post-War Electricity Supply

London J.E.A.'s Criticisms of Memoranda

HAVING considered the memorandum prepared by the I.M.E.A. jointly with the supply companies' associations and that issued by the I.M.E.A. itself, the General Purposes Committee of the London and Home Counties Joint Electricity Authority has set out its views in a report submitted to the Authority.

Dealing first with the joint memorandum, the Committee declares that this cannot be taken in any real sense as a response to the public demand for a post-war plan for operating the electricity supply service on a national or regional basis. It presents a faulty administrative scheme and no financial plan.

The common danger to their local vested interests, the Committee states, seems to have enabled the local authority and company groups to join forces in order to preserve their separate identities. Existing ownerships must not be "subjected to drastic alteration." The transfer of one company undertaking to another or to a holding or financial company is apparently not regarded as a "drastic alteration," as the memorandum is silent on the subject. The Committee asserts that in seeking to prevent any local authority from exercising its statutory right the memorandum is in direct conflict with Government policy and legislative provision. There are something like 200 companies whose primary period of tenure has already ended or will end within the next few years.

The constitution of the proposed area advisory committees—to be appointed by the undertakings in the area—is described by the report as undemocratic. There is no suggestion that local authorities holding purchase rights should be represented. It is provided that such purchase rights shall not in any event be exercised before the formation of an area advisory committee and until the committee has surveyed the whole area, made inquiries and submitted recommendations to the Electricity Commissioners, and also considered and made recommendations for improving the electricity service by some form of grouping. If the committee recommends that a local authority should be allowed to exercise its purchase rights the company undertaking may insist upon the Commissioners holding a local inquiry and thereafter the company has a right of appeal to the Minister of Fuel and Power. On the other hand, the local authority has no right of public inquiry or appeal.

I.M.E.A.'s Position Not Clear

Although the I.M.E.A. is a party to these prejudicial proposals its position is not clear as in a separate memorandum it recommends that in all cases where local authority rights mature the undertaking shall be transferred to public ownership as soon as practicable and, further, that any power company undertaking (not subject to compulsory purchase) within the area should also be transferred.

Referring to various improvements suggested in the memorandum on the lines of the "Reconstruction" debate in the House of Lords on June 17th, 1942, the Committee states that the memorandum proposes that the Commissioners should appoint an advisory committee solely for the purpose of assisting them to divide the country into distribution areas with a wide diversity of load, omitting to state that the Commissioners already have powers to form electricity areas and have virtually done so. No suggestion is made of the means by which the diversity of load is to be secured, nor of the incident financial arrangements between undertakings.

With regard to systems of supply and voltages, the memorandum ignores the fact that complete investigations have been made in the past and no reference is made to the fact that the Commissioners have power to require any undertaking to amend or alter its system. On the subject of uniformity of charges the advisory committee's powers are strictly limited. Definite recommendations were made in the I.E.E. Post-War Planning Committee's report for the application of which only willingness on the part of undertakings is needed.

Financing Rural Supply

The part of the joint memorandum dealing with rural supplies is considered to be depressing and lacking in helpful suggestion. All that it suggests is an investigation by the area committee on the need for supplies and if found to be imperative but too costly, the recommending of a grant of financial aid. The J.E.A. points out that all reports have agreed that the main financial difficulty is the cost of transmission and service lines. If the average receipts for domestic supplies (1937-38 basis) were increased by a tenth of a penny per kWh, or if a further reduction of that amount were postponed for one year, the resulting figure would meet the annual capital charge on a capital contribution for rural development of £55,000,000. If industrial supplies were included the burden per kWh would be reduced to a twentieth.

In conclusion, the General Purposes Committee expresses difficulty in believing that the views expressed are shared by all local authorities owning electricity undertakings and says that it is a hopeful sign, though a peculiar fact, that the second memorandum, issued by the I.M.E.A. only, completely opposes some of the views in the joint memorandum.

The proposal to transfer selected stations to the Central Electricity Board would be a substantial variation of the provisions of the London Electricity Acts, 1925, under which all the London companies' generating stations are to be transferred to the J.E.A. The Committee says that it would have been as well if the I.M.E.A. had first consulted the other public bodies concerned before making its recommendation. In the Authority's own plan provision is made for the transfer or lease to the Central Board of any power station or main transmission line owned by or transferred to the proposed District Electricity Board.

Regarding uniformity of bulk supply charges the Committee says that if the Authority's plan for its own district applied to the country as a whole, the introduction of a national standard bulk supply tariff would naturally follow.

Sound Recording

Progress in Apparatus and Methods

THIS month's discussion evening of the Wireless Section of the Institution of Electrical Engineers was devoted to means of recording and reproducing sound, DR. G. F. DUTTON introducing the subject by comparing the merits of various available systems. He pointed out that the development of the cellulose recording disc had given the recording companies a new tool, making it possible to assess the quality of the recording and reproducer by direct playback, without the doubtful intermediary stage of processing necessary when wax discs had to be used. The relative merits of the lateral-cut and the "hill-and-dale" systems were very close; the latter had now been largely replaced by the former.

The frequency range on the average pre-war record was limited at the high end to 6,000 c/s. Very few gramophones could utilise even this limited range because of the response characteristics of the pick-ups and the surface noise of the records. The recording range could be taken up to 12,000 c/s., which could be preserved without appreciable loss during the factory processing.

Extension of Frequency Range

The desirability of extended range had been a debatable point, and the issue had always been clouded by the intervention of noise. With the direct cellulose playback one could now better appreciate the advantages of extending the frequency range. But before an extended frequency range could be utilised the size and shape of record grooves and of the needle point must receive special attention. In the past a record filler had to be used to grind sharp needle points to a reasonable bearing surface within a few inches of travel. A practically noiseless record without a filler was possible, and any introduction of filler increased noise in proportion to the amount and to the particle size. The war had seen the development of a number of plastics which were extremely interesting from a record-manufacturing point of view.

With reproduction from strip or film the introduction of ultra-violet recording had increased the resolution to such an extent that there was little or no loss up to 12,000 c/s., using the standard film speed of 90 ft./min. The use of normal silver photographic emulsions for printing copies was expensive for domestic gramophones; however, several diaze-dye printing processes were a great deal cheaper. The future of strip or film reproduction depended on the processing costs.

For stereophonic recording at least two channels were necessary and the expense was considerable. The lack of binaural effect in single-channel normal recording had been corrected to a large extent by positioning the microphone and by special acoustic conditions of the studio. The speaker demonstrated recordings of the disc and film types.

Two speakers later indicated the great interest of sound recording to the British Broadcasting Corporation, especially in connection with repeat programmes, which had been greatly increased during the war. The B.B.C. was unable to purchase in this country equipment to fill its requirements and was now using its own design of equipment to take 17-in. discs having 150 grooves per inch; 10,000 cycles had been adopted as the upper limit of the frequency range.

"Cheapjack" Reproduction

More than one speaker saw in the discussion an excellent opportunity for taking stock of the present position of the art and assessing the prospects for the future. In this connection there had been a tendency to disregard the fact that the reproduced sound should at least resemble the original. Cheap gramophones were blamed and it was hinted that in film reproduction also the cheapjack was beginning to make his influence felt. The importance of the co-ordination of electro-acoustic research work was stressed, there being various lines of development under investigation at the present time. A published list of standards was necessary, but nothing authoritative had yet been done in this country. Dissatisfaction was expressed with the present position concerning background noise. Pick-ups of not more than 40-gm. were recommended. The 120-gm. pick-up was said to impose a pressure of some 20 tons to the sq. inch on the needle point. For home use, at least for a long time, it was felt that the disc must predominate over the film.

Although some speakers doubted the necessity of raising the frequency range to 12,000 cycles, the opposite view prevailed and the discussion made it clear that important developments were pending.

Safety in Yorkshire Mines

IN his annual review of Yorkshire coal mines, Major H. J. Humphrys, Divisional Inspector, records that there were no fatal accidents due to the use of electricity, despite the fact that about 360,000 HP of equipment was employed. This was, he felt, a record of which the electrical staffs could be justly proud. However, he mentioned that reports were frequently received of ill-treatment of flexible cables, which were, he said, the weakest link in the whole chain of electrical equipment.

Fire Shock Tests

Displays at Birkenhead

TESTS undertaken at Croydon in 1933 and previously at Bedford, and described in the electrical Press at the time, showed that little danger of shock was likely to personnel using a fire hose and branch pipe when the jet was directed against a 132-kV overhead line. Nevertheless, from questions asked on this matter from time to time, it was felt at Birkenhead that a practical demonstration would be of service, especially to those people who desired to be reassured as to their safety when fire fighting in premises in which electrical apparatus was installed.

Mr. F. W. Brecknell, M.I.E.E., the borough electrical engineer, therefore arranged for exploratory tests to be undertaken by his staff. These tests followed the example of those at Croydon and Bedford, but the target was an iron plate measuring 12 in. by 15 in. supported on post insulators, voltage being applied between the plate and the earthed foot of the insulator support. A ¾-in. straight branch pipe, fed from a water main at 60/80 lb. per sq. in. was suitably supported and directed at the plate which was made alive at 30,000 V from a testing transformer and the voltage on the branch pipe was measured. No voltage could be discerned on the branch pipe until the distance between nozzle and plate was reduced to 12 ft. the reading then being 0·4 V only. A further reduction in the distance to 7 ft. resulted in momentary " kicks " up to 30 V.

Similar tests were made employing a stirrup pump with the nozzle adjusted to give a jet, but no discernible voltage could be read on the voltmeter connected between nozzle and earth.

The next step in the tests was to hold the branch pipe and later the stirrup pump nozzle in the hand and gradually raise the voltage on the plate to 30,000 V, repeating the tests for varying distances between nozzle and plate, down to 20 ft. in the case of the branch pipe and 7 ft. for the stirrup pump. The operator wore leather shoes which were damp from standing on the wet concrete surface and had steel tipped heels, but no shock was felt even when he touched earthed metal with his free hand. Similar tests on various portable fire extinguishers were then carried out without any shock being experienced.

The tests were so satisfactory that a special demonstration was arranged. It was later repeated for the N.F.S. and the Electricity Department's fire brigade, opportunity being afforded to all who wished to handle the equipment.

International Trade

Report of F.B.I. Committee

THE International Trade Policy Committee of the Federation of British Industries has produced a report surveying the conditions likely to govern export and import business after the war and making a number of recommendations. In the forefront the Committee places the need for the preservation of peace and secondly stresses the part played by private enterprise in promoting the community's welfare.

The main objects of post-war trade policy should be, first, to give relief to the devasted countries and, secondly, to frame a world system aiming at the maximum degree of prosperity for all peoples. World prosperity depends upon the prosperity of individual nations. Any inability of Great Britain, the largest purchaser, to continue to import at least on the pre-war scale would react seriously upon other nations and upon the standard of living here.

As Great Britain will be a debtor nation after the war, with its overseas investments diminished, we must increase our visible exports by 40 or 50 per cent. to maintain the pre-war standard of imports.

It is necessary to establish orderly world economy by the control of currency and exchange; to aid countries in need of development by long-term loans ; to institute Government control to prevent anti-social and wasteful conditions, but to limit control to this; and to create an International Economic Council to achieve a world trading system.

This Council would guide the supply of the principal commodities into channels where they would most benefit the producer and consumer and act as co-ordinating body with the aim of helping to raise the standard of living and extend the activities of those countries which needed such aid. Means of regulating imports are studied and licensing rather than tariffs is favoured. Bulk buying and selling by Government agencies should be discontinued when the need ceases to exist, but it is felt that the United Kingdom Commercial Corporation might be of some assistance to the post-war exporter and it is suggested that its activities should be reviewed.

While the importance of the prosperity of the agricultural industry is recognised, any artificial stimulation, it is held, would prejudice our competitive position.

Finally, it is recommended that Empire policy should first be settled by consultation between the Empire countries and that a co-ordinating body should be created in the United Kingdom to enable the various Government Departments to speak with one voice on Empire matters.

The members of the Committee include Mr. A. W. Berry, Sir Frank Gill, Capt. B. H. Peter and Mr. V. Watlington.

War Damage Insurance

The Board of Trade has decided that in respect of the six months beginning April 1st, the rate of premium payable under policies issued under the Business Scheme shall continue at 5s. per cent.

ELECTRICITY SUPPLY

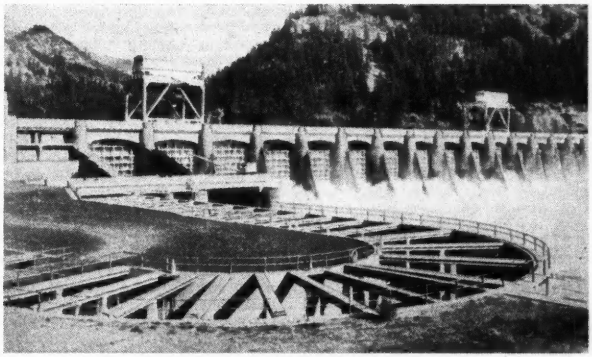
Deficit at Stoke Newington. Completion of Bonneville Dam

London.—STOKE NEWINGTON FINANCES.—At this week's meeting of Stoke Newington Borough Council the annual accounts of the electricity undertaking for 1942-43 were submitted. These show a net deficiency of £11,068, and towards this it has been necessary to apply the remainder of the reserve fund, the balance of the deficit (£10,223) being transferred to the general rate fund. The balance standing to the credit of the reserve fund at April 1st, 1942, was £27,514, and to this was added £752 income from investments and a profit of £615 realised on the sale of investments, making £28,881. This amount has been applied as follows: Deficit 1940-41, £12,938; deficit 1941-42, £15,097; and on account of deficit 1942-43, £945. The report of the Electricity Sub-committee points out that Government assistance is not given to electricity undertakings so long as they have reserve funds, invested or uninvested. This, in effect, necessitated the realisation of the reserve fund investments in order to provide liquid funds before the Council could apply for financial assistance in respect of the undertaking. A sub-committee of four has been appointed to examine details of the undertaking's accounts.

Rothesay.—POST-WAR POWER NEEDS.—Mr. A. E. Earls, burgh electrical engineer, reported to the Town Council that additional generating capacity would be required as soon as the war was over. It appeared that the North of Scotland Hydro-Electric Board contemplated supplying Cowal and Bute from one of its proposed large hydro-electric developments, and would probably object to the Council's installing new generating plant. It seemed to Mr. Earls, however, that it would be several years after the war before a supply would be available from any of the Board's schemes. He was authorised by the Council to approach the Electricity Commissioners, and, if necessary, the Hydro-Electric Board, with regard to the burgh's position.

Overseas

United States.—BONNEVILLE SCHEME COMPLETED.—The Bonneville Dam hydro-electric project begun ten years ago was completed with the recent formal commissioning of the tenth generating unit, making the total capacity 516,400 kW. The first three main generators were of 42,200 kW each and the last seven 54,000 kW and all have been manufactured at the General Electric works at Schenectady. When plans were made for the development of the Columbia River by the construction of ten dams Bonneville was chosen for the first down-river, states the *Electrical World*. Other dams among the ten originally projected are Grand Coulee, constructed by the Bureau of Reclamation, and Rock Island dam, completed in 1933 by the Puget Sound Power & Light Co. The Bonneville-Grand Coulee network of transmission lines covers 2,524 miles and the total substation transformer capacity is 2,500,000 kVA. Altogether, the Bonneville scheme has cost $81,386,000, including $39,431,477 for power plant.



Bonneville Dam, which was recently completed by United States Army engineers when the tenth unit was installed

RADIO & TELEPHONY

Great Britain.—RADIO LICENCES.—In the House of Commons last week, Mr. Thorne asked how many radio licences in Britain and Northern Ireland had been taken out for 1943. Capt. Grimston, the Assistant Postmaster-General, said that the number of broadcast wireless receiving licences issued in Great Britain and Northern Ireland during the year 1943 was approximately 9,436,000.

CAR RADIO RESTORED.—The Postmaster-General announces that radio sets may again be carried in road vehicles without a special permit. Owners of sets which were impounded by the police in 1940 may have them restored upon application.

TRANSPORT

South Africa.—FURTHER ELECTRIFICATION.—In his statement regarding plans for the future Mr. Sturrock, Minister of Railways and Harbours, announced that after the war it was intended to spend £30 million on extensions and improvements, including the electrification of the main line from Capetown to Touws River.

Aberdeen Jubilee

Salient Dates in the Electricity Department's History

UNDER the Aberdeen Electric Lighting Order, 1890, the Corporation was granted powers to supply electrical energy within the city and royal burgh as then constituted. In December, 1892, Professor Kennedy was appointed consulting engineer to prepare a scheme, and the first tenders to carry out the work were accepted in May, 1893. The first supply was given on February 27th, 1894, when Mrs. Stewart, wife of the Lord Provost, switched on ten public arc lamps in Union Street and Castle Street. The first private consumers were connected on March 7th, 1894, at which time applications for supply to 35 premises had been received. To-day the Corporation is the authorised supplier in an area of 97¾ sq. miles.

The original generating plant at Cotton Street consisted of five small non-condensing steam engines driving DC dynamos with a total rating of 257 HP. Supply was given on the three-wire system at 110 and 220 V and the mains consisted of copper strips laid in concrete culverts constructed under the pavements. The supply pressure was raised to 220 and 440 V in 1897.

Origin of Present Station

By 1899 (when the electrification of the tramway system was commenced), the site at Cotton Street had reached the limit of development, and the Corporation decided to utilise the site of the old Dee Village for the erection of the present works. A temporary station was erected on the new site and brought into use for the first time on November 4th, 1901, while the permanent buildings were officially opened by Lord Provost Walker on March 20th, 1903. The Cotton Street station was gradually dispensed with, and in 1905, the site and buildings were finally disposed of to the Gas Department.

A new stage of development was reached in 1911 by the installation of the first steam turbine as a prime mover driving a DC generator of 1,000 kW, followed the next year by a similar sized turbine driving an alternator. All subsequent extensions have been turbine-driven alternators, and the last of the reciprocating sets were removed to make room for the 12,500 kW which was put into operation in 1928.

The original boiler-house had reached the limit of its development shortly after the last war and in 1921 the Town Council sanctioned a scheme for the modernisation and enlargement of the station. The new scheme provided for boilers capable of working at 250 lb. per sq. in. The most recent developments started in 1935. Two new boilers were completed in the spring of 1938 and the installation of a 15,000-kW turbine set and provision of new circulating water tanks were finished in 1939.

The Corporation has always adopted a policy of supplying electricity as cheaply as possible and of providing all necessary facilities. Thus, the charging of rents for the meters was abolished as early as 1897. In 1899, it was decided to exhibit in the Gas Stove Depot such forms of radiators, cookers, and irons as were then available, and in 1899 the Corporation agreed to hire out electric motors for power purposes, being one of the first supply authorities in the country to provide this facility. In this connection it is worthy of record that some of the motors purchased in the first year of the hiring scheme are still in service, a testimony both to good workmanship in their manufacture and maintenance care which has since been given them by the Corporation's employees.

Low charges for heating and cooking in domestic premises have been available from a very early date, and a two-part domestic tariff was introduced in 1925, followed the next year by an assisted wiring scheme which met with immediate and continuing success until it was suspended on the outbreak of war. The Department has had its own showrooms since 1909, and the first portion of the present showroom was opened in 1929.

Gas Engineer in Charge

At the outset the supply of electricity was placed under the charge of the gas engineer, and in this connection it is interesting to recall that the late Mr. Samuel Milne played an important part under the then gas engineer in the early development of the undertaking. The gas engineer ceased to have charge of the Electricity Department in 1903. The first electrical engineer was Mr. E. T. Ruthven Murray, who was appointed in 1893. He resigned in 1895 on obtaining another appointment and was succeeded by Mr. A. S. Blackman, who resigned for a similar reason in 1898. Mr. J. A. Bell was then appointed and held office for the long period of 38 years until he retired in 1936. The present city electrical engineer, Mr. A. Gardner, B.Sc. (Eng.), M.I.E.E., was appointed in 1937.

From the early records it appears that when supply was commenced there were five full-time employees, whose wages for a normal week amounted to £5 7s. The average number of employees is now about 410, and the wages bill amounts to £1,700 per week.

The jubilee was marked on February 28th by a civic luncheon at which employees of Department were entertained.

American Electrical Appliance Situation

SMALL electrical household appliances such as mixers, juice extractors and heating pads, cannot be made in America in the near future because copper wire is not plentiful enough, states the Office of Civilian Requirements of the U.S. War Production Board. Electric irons will be made under a programme already approved by the War Production Board.

The announcement states that, contrary to common belief, reductions in the small arms programme have not resulted in a surplus of copper. The supply of copper now equals the demand, but the margin of balance is so narrow that a slightly increased use of copper can be permitted only for a few essential items directly or indirectly connected with the war effort.

Revised I.E.E. Regulations

Change in Cable Colours

THE eleventh edition of the Regulations for the Electrical Equipment of Buildings has been issued by the Institution of Electrical Engineers in a revised form (under date December, 1943).

The text now incorporates the alterations and additions contained in the supplements of February 22nd, 1940, and February 6th, 1943, and lines ruled in the margin indicate where the text differs from that of the version of June, 1939. Among the more important differences is one that relates to the interpretation of Electricity Supply Regulation 4 (*iv*) of the Electricity Commissioners which prescribes that the earth connection of the neutral point of an undertaking's transformer may not be opened while the circuit is alive; the effect of the modification to Regulation 112 will be to make single-pole fusing general practice.

An important addition to the previous supplementary modifications is the change made in cable colours. Bright blue (easily distinguishable from black) will take the place of green for three-phase three- and four-wire systems. The need for the manufacture of two kinds of three-core cables is obviated by making the standard colours red, white and blue. Earth continuity conductors in flexible cords and cables will have coverings of green instead of brown, which will not only be more in conformity with overseas practice, but will also meet criticisms regarding difficulty of distinguishing colours under diverse lighting conditions.

A few minor editorial alterations have been made, but the note to Regulation 301 still refers to Table 4 as showing the weight of standard conductors, whereas only dimensions and resistances are given. Attention should be drawn also to the amendment to No. 1301, which gives the appropriate clause of B.S.S. 842 as 12 instead of 11 (as in the original eleventh edition). The War Emergency Relaxations of June, 1942, are pasted inside the front cover and reference is made to five War Emergency B.S. adopted as Codes of Practice.

Copies of the revised eleventh edition are obtainable from the Institution or from E. & F. N. Spon, Ltd., at 1s. 9d. post free in cloth and 1s. 3d. in paper. Copies of the two supplements are also available separately.

Forthcoming Events

Institution of Electrical Engineers.—Thursday, March, 16th, 5.30 p.m. "An Analysis of the Load on a Modern Electricity Supply System," by Mr. P. Schiller.

Transmission Section.—Wednesday, March 8th, 5.30 p.m. "Reinforced Concrete Transmission Line Supports," by Messrs. E. C. Neate and W. F. Bowling.

Installations Section.—Thursday, March 9th, 5.30 p.m. "The Influence of Maintenance Requirements on the Design of Electrical Installation Equipment," by Mr. Hamlyn Drake, M.A.

Mersey and North Wales (Liverpool) Centre.—Monday, March 6th, 5.30 p.m. Liverpool Royal Institution, Colquitt Street. Papers on "The Future of the Domestic Wiring Installation," by Messrs. W. J. H. Wood and Forbes Jackson ("Immediate Developments"), and Messrs. G. W. Smith and E. Jacobi ("The Distant View").

Cambridge and District Wireless Group.—Monday, March 6th, 5.30 p.m. (tea, 5 p.m.). Cambridge Technical School, Collier Road. "Enemy Airborne Radio Equipment," by Mr. C. P. Edwards, M.Sc.Tech.

North-Eastern Students' Section.—Friday, March 10th, 6.30 p.m. Neville Hall, Newcastle-on-Tyne. "High-voltage Technique in Atomic Physics," by Mr. J. M. A. Lenihan.

Western Centre.—Monday, March 13th. Cardiff. Paper on "Transmission and Distribution of Electricity to Mines," by Mr. B. L. Metcalf.

North-Eastern Centre.—Monday, March 13th, 6.15 p.m. Neville Hall, Newcastle-on-Tyne. "Instrument Transformers," by Mr. A. Hobson, B.Sc.Tech.

Scottish Centre.—Wednesday, March 15th. Edinburgh. "The University Education and Industrial Training of Engineers, with particular reference to Telecommunications," by Prof. Willis Jackson.

North Midland Students' Section.—Saturday, March 11th, 2.30 p.m. Griffin Hotel, Leeds. "Problems Afternoon."

London Students' Section.—Wednesday, March 15th, 7 p.m. "Electrical Engineering Research," by Mr. H. W. H. Warren, M.Sc.

Royal Society of Arts.—Monday, March 6th, 1.45 p.m. John Adam Street, Adelphi, London, W.C.2. Cantor Lecture on "Hydro-electric Power," by Sir William Halcrow, M.Inst.C.E.

Wednesday, March 15th, 1.45 p.m. "Gutta Percha and Balata, with special reference to their use in Submarine Cable Manufacture," by Mr. J. N. Dean, B.Sc., A.I.C. (Telegraph Construction & Maintenance Co. Ltd.)

Illuminating Engineering Society.—*Bath and Bristol Centre.*—Monday, March 6th, 7 p.m. Grand Hotel, Broad Street, Bristol. Dr. H. Buckley's presidential address.

Association of Mining Electrical and Mechanical Engineers.—*West of Scotland Branch.*—Saturday, March 11th. Film display. "On-load Tap Change Devices," and "Oil Fire Fighting."

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The English Electric Co., Ltd., held its twenty-fifth annual meeting last week. Sir George H. Nelson, chairman and managing director, said that he would have liked to commemorate this silver jubilee in some way, even if only by the publication of a brochure describing some of their achievements, particularly during the last four or five years. However, when it was possible to give this information he was sure that it would be agreed that the company's efforts had been worthy of its great traditions.

Sir George Nelson

Dealing with the report and accounts, the chairman explained that the increase of £41,972 in the issued ordinary stock was the result of the completion of the exchange of shares with the holders of ordinary shares in D. Napier & Son, Ltd. Their holding in that company was now brought up to 2,184,000 5s. shares, being the total issued. Liquid assets had increased slightly to £2,987,603 and were fast approaching the £3,000,000 mark. The general reserve now stood at £900,000 and the chairman later, in a reference to the tax situation and their unfair standard year, said that he had not overlooked the fact that they had a possible hidden reserve arising out of E.P.T. payments. Turning to the profit and loss account, he pointed out that the profit was £11,786 more than in the previous year.

As regards the accounts of Napiers, the trading profit, after providing for taxation and all charges arising from the transfer of control, amounted to £209,669. From this had been deducted directors' fees £934, and depreciation £131,933, leaving a balance of £76,802. He explained that the bank overdraft of £1,714,798 was caused by an increase in the volume of business and was self-liquidating when the volume fell to the normal level. Also, a sum of £750,000 would be paid to the company by the Government for certain fixed assets.

The chairman spoke of the magnificent efforts of the staff and workpeople and assured them that the company would continue to exert itself to secure stability of employment for the greatest number. The main controlling factor would be the ability of the industry and the company, by the excellence of their designs and efficiency of production, to meet the coming world competition. He mentioned that since 1937 the company had paid well over £300,000 to the trustees in respect of the pension schemes and in conclusion referred to the men and women from the company—upwards of 2,500—with the forces.

Westinghouse Brake & Signal Co., Ltd.—The managing director (Capt. B. H. Peter, C.B.E.) presided at last week's meeting in the absence through illness of the chairman (Lord Herbert Scott) and read the latter's speech. This referred to the retirement of Lord Southborough from the chair and other changes in the board and reviewed the accounts. Capt. Peter then spoke of the company's future policy. He said that they had built up a strong financial position which would prove of service in the time to come. A great deal of deferred maintenance work would have to be done. Wartime processes and methods had developed and they would have to consider whether they must not adopt some of these to suit their industry even if it meant the scrapping of present plant and expenditure on new machines and methods.

In one pre-war year 50 per cent. of the company's total output was exported. During the war the export business had dwindled considerably and it would not regain its volume unless they took active steps. They would need to send their people abroad to re-establish contacts, study the changed conditions and again adapt themselves to meet the requirements.

The Consolidated Signal Co., Ltd., reports a net profit of £27,220 for the year ended September 30th last after providing for taxation, as compared with £24,302 in the previous year. The dividend on the ordinary stock is being raised from 2½ to 2½ per cent.

E. K. Cole, Ltd., announced recently that they had acquired a controlling interest in Ensign Lamps, Ltd. It has now been decided that a complete merger is desirable and the holders of the remaining shares in Ensign Lamps (76,000 out of 300,000 5s. shares) are offered five 5s. ordinary shares in E. K. Cole for each six Ensign shares.

The Midland Counties Electric Supply Co. states that the trading profit of its operating companies for 1943 (after meeting taxation) was £854,041, as compared with £830,730 for 1942. Of this £528,072 (£505,399) is appropriated for depreciation and reserves of operating companies. The holding company's net revenue (after taxation) was £269,779 (against £272,841). The final dividend on the ordinary stock is 5 per cent., again making 8 per cent. for the year.

The British Power & Light Corporation, Ltd., reports a net profit (before provision for taxation) of £335,483 for the year ended December 31st last. This compares with £348,624 for 1942. A final dividend of 5 per cent. is to be paid, making 7 per cent. (same).

The North Wales Power Co., Ltd., is paying a dividend of 5 per cent. for the year ended December 31st last, as against 6 per cent. in the previous year.

The Lancashire Electric Light & Power Co., Ltd., is to pay a final dividend of 5 per cent. on its ordinary stock, again making 7½ per cent., and an additional ½ per cent. on the participating preference stock, making 7½ per cent. (same).

The North-Eastern Electric Supply Co., Ltd., announces a final ordinary dividend of 4½ per cent., again making 7 per cent. for the year.

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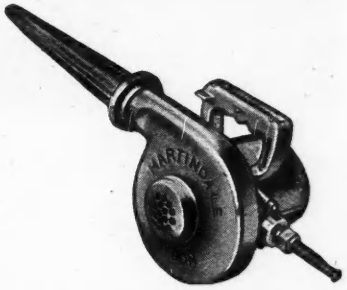

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The Llanelly & District Electric Supply Co., Ltd., which for 1942 raised its ordinary dividend from 5½ to 6 per cent., proposes to maintain the distribution at the higher rate in respect of 1943.

The Power Securities Corporation, Ltd., reports a gross revenue of £113,632 for 1943, as compared with £118,492 for the preceding year. The net profit rose from £50,664 to £52,834, due to lower taxation. The dividend is again 6 per cent. and £49,737 (against £38,403) is carried forward.

The Electrical Distribution of Yorkshire, Ltd., is maintaining its ordinary dividend for the past year at 9 per cent. by a final payment of 4½ per cent.

The Folkestone Electric Supply Co., Ltd., is to make a two years' payment on its 5 per cent. cumulative preference shares up to September 30th, 1942.

The Richmond (Surrey) Electric Light & Power Co, Ltd., is recommending a dividend of 6 per cent. for 1943 (same).

The South London Electric Supply Corporation, Ltd., is maintaining its ordinary dividend at 7 per cent. for 1943. The dividend will be paid in part by drawing upon reserves.

The Mid-Cheshire Electric Supply Co., Ltd., is again paying a dividend of 8 per cent. for the past year.

Oliver Pell Control, Ltd., announces payment of a dividend of 3 per cent. on the 6 per cent. participating preference shares in respect of the half year ended June 30th, 1941.

Ransome & Marles Bearing Co., Ltd., is paying an interim dividend of 9 per cent., the same as last year.

Bruce Peebles & Co., Ltd., are again paying a dividend of 5 per cent. with a bonus of 3 per cent. for the past year.

The Hoffman Manufacturing Co., Ltd., is maintaining its dividend of 17½ per cent., free of tax, by a final payment of 10 per cent., free of tax.

The Plessey Co., Ltd., has declared a second interim dividend of 10 per cent., as last year.

The British Columbia Power Corporation has declared a dividend of 40 cents per "A" share for the three months ending March 31st (against 50 cents).

New Companies

E. A. Wood, Ltd.—Private company. Registered February 21st. Capital, £50,000. Objects: To acquire the business of a wholesale distributor of electrical and radio apparatus and manufacturer formerly carried on by Edward A. Wood, senior, as E. A. Wood at Midland Lighting Works, 100, Aston Road, Birmingham, and elsewhere. Directors: E. A. Wood, sen., The Sycamores, Wood End Road, Erdington, Birmingham, and two others. Secretary: A. V. Wood. Registered office: 100, Aston Road, Birmingham.

Marbaix Industries, Ltd.—Private company. Registered February 17th. Capital, £100,000. Objects: To carry on the business of importers, exporters, manufacturers, assemblers, installers and repairers of, and dealers in, tools, engineering specialities, wireless, telegraphic and electrical apparatus, etc. First directors: G. E. L. J. Marbaix and Flt./Sgt. G. E. H. Marbaix, both of Holmstead Manor, Cuckfield, Sussex. Solicitors: Williams and Poole, 106, Fulham Road, S.W.3. Registered office: Humglas House, 22, Carlisle Place, S.W.1.

Grinyer & Co., Ltd.—Private company. Registered February 18th. Capital, £3,000. Objects: To acquire the business of electrical engineers carried on by W. E. Germain and T. E. Nankivell at Arch 443/4, Baythorne Street, E.3. Directors: W. E. Germain, 12, Springfield Court, Corbets Tey Road, Upminster, Essex, and T. E. Nankivell, 15, Lake Rise, Romford. Registered office: Arch 444, Baythorne Street, Burdett Road, E.3.

Radio Electrical & Television Co., Ltd.—Private company. Registered February 11th. Capital, £1,000. Objects: To carry on the business of television and wireless electricians, engineers, scientific instrument makers, etc. Directors: R. A. Talbot, 11, Bankes Lane, Weston, near Runcorn, Cheshire; and J. H. Prescott, 5, Windsor Grove, Runcorn. Registered office: 76a, Greenway Road, Runcorn.

Carman Radio & Electrical, Ltd.—Private company. Registered February 16th. Capital, £5,000. Objects: To carry on the business of electricians, radio and television engineers, etc. J. Carman, 9, Quarry Rise, Tonbridge, Kent, is permanent governing director. Registered office: 1, Lloyd Road (Station Gates), High Street, Broadstairs, Kent.

Companies' Returns

Statements of Capital

Sudan Light & Power Company, Ltd.—Capital, £500,000 in £1 shares (406,000 ordinary and 94,000 preference). Return dated November 22nd. 406,000 ordinary and 52,000 preference shares taken up. £458,000 paid. Mortgages and charges: £400,000.

Killamarsh & District Electric Supply Co., Ltd.—Capital, £6,000 in £1 shares (all ordinary). Return dated October 23rd (filed November 8th). 4,725 shares taken up. £4,725 paid. Mortgages and charges: Nil.

Colombo Electric Tramway & Lighting Co., Ltd.—Capital, £150,000 in £10 shares. Return dated October 5th. 13,084 shares taken up. £840 paid. £130,000 considered as paid. Mortgages and charges: Nil.

Corwen Electric Light Co., Ltd.—Capital, £2,000 in £1 shares. Return dated November 18th. 1,610 shares taken up. £1,610 paid. Mortgages and charges: Nil.

Increases of Capital

London Electrical Co. (Blackfriars), Ltd.—At an extraordinary general meeting held on February 16th, it was resolved that the nominal capital of the company should be increased by the addition of £7,500 in 7,500 ordinary shares of £1 each, beyond the registered capital of £20,000.

Thompson Ritchie & Co., Ltd.—The nominal capital has been increased by the addition of £1,000 in £1 ordinary shares beyond the registered capital of £1,000.

STOCKS AND SHARES

TUESDAY EVENING.

STOCK EXCHANGE markets continue to attract a steady flow of orders, mostly of the investment type, and this has the effect of keeping prices fairly firm. The effect of the air raids upon London is to slow down business. Uncertainty as to what physical damage may be done to property is the main reason which restricts activity. There is, however, plenty of money about: money, too, that is constantly on the lookout for promising channels of employment. The air-raid menace has left its mark upon shares in wireless, cinema and allied companies. Prices in these issues have weakened, and for the time being the market is depressed.

Home Electricity Supply

The outbreak of fresh nocturnal activity on the part of the enemy recently has had no effect upon the prices of Home electricity supply shares. It is true that a few came in, but the selling served to supply a demand which had previously existed and for which there had been no shares available. Proprietors of electricity supply shares evidently do not intend to allow themselves to be frightened out of their interests, at any rate for the present.

Bournemouth and Poole are 6d. better at 63s. and Edmundsons 7 per cent. preference at 34s. 6d. have gained a similar amount. Beyond these rises the list is practically unchanged.

Radio Falls

The effect of the air raids is seen chiefly in the groups concerned with shares in radio, entertainment and kindred companies. Southern Railway preferred at 76½ has lost most of last week's advance, renewed caution being induced by the possibilities of damage to rolling stock, etc. E.M.I. shares shed 6d., easing off to 28s. Philco have fallen from 12s. 3d. to 11s. 6d. and Cossor at 23s. are 1/16 down. The change is noticeable as much in its disposition as in actual price movements. Whereas it was an easy matter to sell shares in sizeable quantities a fortnight or so ago, to-day, the buyer can get on more easily than the seller. Dullness takes the place of previous optimism founded upon post-war prospects of television and of present radiolocation.

Dividends

Most of the electricity supply companies are declaring similar dividends to those of a year ago. The North Wales Power Company has reduced its dividend by 10s. per cent. to 5½ per cent. The shares are held by the British Light & Power Corporation, which has announced a final dividend of 5 per cent. making 7 per cent. for the year, as before. The Folkestone Electricity Supply Co. is about to pay off two years' arrears of dividend on the 5 per cent. preference shares. This leaves only one year's arrears to be met. The shares stand at 22s.

Transport "C"

Conflicting views prevail as to the prospective value of London Passenger Transport "C" stock, the dividend on which has been raised by 5s. to 3½ per cent. At the present price, the yield on the money is £4 18s. 6d. per cent.; considerably less, that is to say, than the return available from such stocks as Southern Railway preferred, Great Western and London Midland & Scottish. The reason for the price standing comparatively high, as matched against those of the three just quoted, is that holders look forward to the end of the war, with anticipated expansion of the dividend on the stock.

The full "standard" rate is 5½ per cent., though this is a figure which the greatest optimist can scarcely expect to see realised for some time to come. Some people think, however, that the dividend might be put up to 4 per cent. The effect of Thomas Tilling, Ltd., including in its recent balance sheet its large holding of Transport "C" stock at 80, is accepted as a hint that the Tilling directors consider the post-war prospect to be encouraging.

Price Fluctuations

Prices of shares in the manufacturing and equipment section show a majority of gains. Crompton Parkinsons at 29s. are up 1s. and the yield, on the recently advanced dividend of 22½ per cent., has dipped to 3⅞ per cent. Hopkinsons are 1/16 higher at 3½. Falk Stadelmann shares, which seldom move, are 9d. better at 33s. 6d. Henley's 4½ per cent. preference put on 1s. at 24s. upon a moderate inquiry. Improvements have lifted Allen West to 7s. 3d., Murex to 5⅛, Johnson & Phillips to 70s. 6d. and Ferranti preference to 30s. Dividend anticipations brought further improvement to Vactrics at 14s. Lancashire Dynamo, still under the influence of the increased dividend, are firmer at 93s. On the other side of the shield, falls have occurred in Electric Constructions at 50s. and Tube Investments at 96s. 3d.

Babcock & Wilcox

In the attention that investment is now paying to shares in companies connected with heavy industries, Babcock & Wilcox are naturally conspicuous because the company is, of course, one of the best known in its class, and for years has been a consistently

(*Continued on page* 320)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend: Previous	Dividend: Last	Middle Price Feb. 29	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies					
Bournemouth and Poole	12½	12½	63/-	+6d.	3 19 4
British Power and Light	6	7	33/-	..	4 4 10
City of London ..	7	5½	28/-	..	3 18 7
Clyde Valley ..	8	8	42/-	..	3 16 0
County of London	8	8	41/6	..	3 17 0
Edmundsons:					
7% Pref. ..	7	7	34/6	+6d.	4 1 4
Ord.	6	6	29/-	..	4 2 9
Elec.Dis.Yorkshire	9	9	45/-	..	4 0 0
Elec. Fin. and Securities ..	12½	12½	55/-	..	4 11 0
Elec. Supply Corporation ..	10	10	47/-	..	4 5 0
Isle of Thanet ..	Nil	Nil	18/-	..	—
Lancs. Light and Power ..	7½	7½	37/-	..	4 1 1
Llanelly Elec. ..	5½	6	25/-	..	4 16 0
Lond.Assoc.Electric	4	3	24/-	..	2 10 0
London Electric	6	6	29/-xd	..	4 2 9
LondonPowerRed. Deb.	5	5	105½	..	4 14 7
Metropolitan E.S.	8	8	42/-	..	3 16 0
Midland Counties	8	8	41/-	..	3 18 0
Mid. Elec. Power	9	9	44/6	..	4 0 9
Newcastle Elec.	7	7	31/6	..	4 9 0
North Eastern Elec.:					
Ordinary ..	7	7	34/-	..	4 2 4
7% Pref. ..	7	7	35/-	..	4 0 0
Northampton ..	10	10	48/-xd	..	4 3 4
Notting Hill 6% Pref. (£10) ..	6	Nil	11	..	—
Northmet Power:					
Ordinary ..	7	7	39/6	..	3 11 0
6% Pref. ..	6	6	30/8	..	3 18 8
Richmond Elec. .	6	6	26/-	..	4 12 4
Scottish Power ..	8	8	40/6	..	3 19 0
Southern Areas..	5	5	23/-	..	4 7 0
South London ..	7	7	27/-	..	5 3 8
West Devon ..	5	5	23/6	..	4 5 0
West Glos. ..	4½	3½	24/-	..	2 18 4
Yorkshire Elec...	8	8	43/-	..	3 14 5
Overseas Electricity Companies					
Atlas Elec. ..	Nil	Nil	6/-	..	—
Calcutta Elec. ..	7•	6•	37/6	−6d.	3 4 2
Cawnpore Elec...	10	10	35/-	..	5 14 3
East African Power	7	7	33/-	..	4 4 10
Jerusalem Elec...	7	5	28/6	..	3 10 2
Kalgoorlie (10/-)	5	5	10/-	..	5 0 0
Madras Elec. ..	4•	Nil	23/6	..	—
Montreal Power..	1½	1½	23½	+½	6 7 8
Palestine Elec."A"	4•	5•	40/3	..	2 9 10
Perak Hydro-elec.	6	7	10/-	..	—
Shawinigan Power	83cts.	90cts.	16½	−½	—
Tokyo Elec. 6%	6	6	18	..	—
VictoriaFallsPower	15	15	4½	..	3 9 7
Whitehall Inv.Pref.	—	6	24/-	..	5 0 0

Company	Dividend: Previous	Dividend: Last	Middle Price Feb. 29	Rise or Fall	Yield p.c. £ s. d.
Public Boards					
Central Electricity:					
1955 60 Civil Defence) ..	—	2	100	..	3 0 0
1955-75 ..	5	5	116	..	4 6 2
1951-73 ..	4½	4½	107	..	4 4 1
1963-93 ..	3½	3½	104	..	3 7 4
1974-94 ..	3½	3½	101	..	3 4 6
London Elec.Trans. Ltd.	2½	2½	97	..	2 11 3
London & Home Counties1955-75	4½	4½	112	..	4 0 4
Lond.Pass.Trans.:					
A	4½	4½	123½	..	3 13 0
B	5	5	121½	..	4 2 4
C	3	3½	66	..	4 18 6
WestMidlandsJ.E.A. 1948-68 ..	5	5	109½	..	4 11 4
Telegraph and Telephone					
Anglo-Am. Tel.:					
Pref.	6	6	117	..	5 2 5
Def.	1½	1½	28	..	5 7 2
Anglo-Portuguese	8	8	24/6	..	6 10 7
Cable & Wireless:					
5½ Pref. ..	5½	5½	115	+1	4 15 6
Ord.	4	4	8½	+½	4 19 5
CanadianMarconi$1	Nil	4cts.	9/-	..	—
Globe Tel.& Tel.:					
Ord.	8½•	5•	37/6	..	2 13 4
Pref.	6	6	30/-	..	4 0 0
Great NorthernTel. (£10)	Nil	Nil	20½	..	—
Inter. Tel. & Tel.	Nil	Nil	15	−1	—
Marconi-Marine..	7½	7½	33/-	..	4 11 0
Oriental Tel. Ord.	16	10	44/-	..	—
Telephone Props.	6	Nil	16/-	..	—
Tele.Rentals(5/-)	10	10	11/6	..	4 7 0
Traction and Transport					
Anglo-Arg.Trans.:					
First Pref. (£5)	Nil	Nil	2/6	..	—
4% Inc. ..	Nil	Nil	7½	−½	—
Brit.Elec.Traction:					
Def. Ord. ..	45	45	1115	..	4 0 7
Pref. Ord. ..	8	8	175	..	4 11 5
Bristol Trams ..	10	10	54/-	+1/6	3 14 2
Brazil Traction .	$1	$1½	26½	−½	6 17 6
Calcutta Trams..	5½	6½	39/6	..	3 5 10
Cape Elec. Trams	5	6	26/-	..	4 12 4
Lancs. Transport	10	10	44/3	..	4 10 4
Mexican Light:					
1st Bonds ..	5	5	100½	..	4 19 7
Rio 5% Bonds ..	5	5	106½	..	4 13 9
Southern Rly.:					
5% Prefd. ..	5	5	76½	−1½	6 10 9
5% Pref. ..	5	5	117½	−½	4 5 1
T. Tilling ..	10	10	58/-	+6d.	3 9 0
West Riding ..	10	10	44/6	..	4 10 0

(Continued on next page)

• Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price Feb. 29	Rise or Fall	Yield p.c.
Equipment and Manufacturing					£ s. d.
Aron.Elec.Ord. ..	10	15	55/-	..	5 9 1
Assoc. Elec. :					
Ord.	10	10	52/-	..	3 17 0
Pref.	8	8	39/6	..	4 1 0
AutomaticTel.&Tel.	12½	12½	61/3	+⅛	4 1 8
Babcock & Wilcox	11	11	50/-	..	4 8 0
British Aluminium	10	10	48/-	..	4 3 4
British Insul. Ord.	20	20	5⅛	..	3 15 4
British Thermostat (5/-)	18½	18½	19/-	..	4 17 4
BritishVac.Cleaner (5/-)	15	30	27/-	−6d.	5 11 1
Brush Ord.(5/-)..	6	8	8/6	..	4 14 2
Burco (5/-) ..	15	17½	15/6	..	5 13 0
Callender's ..	15	20	101/3	..	3 18 9
ChlorideElec.Storage	15	15	80/-	..	3 15 0
Cole, E. K. (5/-)	10	15	25/6	−9d.	2 18 10
Consolidated Signal	24	27½	5½xd	..	4 13 6
Cossor, A. C. (5/-)	7½•	10•	23/-	−⅛	2 3 6
Crabtree (10/-) ..	17½	17½	38/3	..	4 11 5
Crompton Parkinson Ord. (5/-) ..	20	22½	29/-	+1/-	3 17 7
E.M.I. (10/-) ..	6	8	28/-	−6d.	2 17 2
Elec.Construction	10	12½	50/-	−6d.	5 0 0
EnfieldCableOrd.	12½	12½	59/-	..	4 4 8
Engish Electric .	10	10	50/6	..	3 19 3
EnsignLamps(5/-)	25	15	20/-	..	3 15 0
Ericsson Tel. (5/-)	22•	20•	51/3	..	1 19 0
Ever Ready (5/-)	40	40	39/-	..	5 2 7
Falk Stadelmann	7½	7½	33/6	+9d.	4 9 7
Ferranti Pref. ..	7	7	30/-	+6d.	4 13 4
G.E.C. : Pref.	6½	6½	34/-	..	3 16 6
Ord.	17½	17½	92/-	..	3 16 1
Greenwood&Batley	15	15	41/3	..	7 5 9
HallTelephone(10/-)	12½	12½	26/-	..	4 16 1
Henley's (5/-) ..	20	20	26/3	..	3 16 2
4½% Pref. ..	4½	4½	24/-	+1/-	3 15 0
Hopkinsons ..	15	17½	62/6	+⅛	5 12 0
India Rubber Pref.	5½	5½	21/6	..	5 2 4
Intl. Combustion	30	30	6½	..	4 18 0
Johnson & Phillips	15	15	70/6	+6d.	4 5 2
LancashireDynamo	20	22½	93/-	+6d.	4 16 6
Laurence,Scott(5/-)	12½	12½	13/-	..	4 16 2
London Elec. Wire	7½	7½	34/6	..	4 7 0
Mather & Platt..	10	10	55/-xd	..	3 12 9
Metal Industries(B)	5	8	44/3	..	3 13 2
Met.Elec.CablePref.	5½	5½	21/3	..	5 3 6
Murex	20	20	102/6	+6d.	3 18 2
Pye Deferred (5/-)	25	25	26/3	..	4 15 3
Revo (10/-) ..	17½	17½	38/6	..	4 11 0
Reyrolle ..	12½	12½	68/9	..	3 12 8
Siemens Ord. ..	7½	7½	33/6	..	4 9 7
Strand Elec. (5/-)	7½	10	7/9	..	6 9 0
Switchgear& Cowans (5/-) ..	10	20	18/-	..	5 11 1
T.C.C. (10/-) ..	5	5	18/9	..	2 13 4
T.C. & M. ..	10	10	52/-	..	3 17 0
TelephoneMfg.(5/-)	9	9	11/-	..	4 1 10
Thorn Elec. (5/-)	20	20	22/6	..	4 9 0
Tube Investments	20	20	96/3	−9d.	4 3 4
Vactric (5/-) ..	Nil	Nil	14/-	+9d.	—
Veritys (5/-) ..	7½	7½	7/6	..	5 0 0
Vickers (10/-) ..	10	10	19/-	..	5 5 3
WalsallConduits(4/-)	55	55	44/6	..	4 18 9
Ward & Goldstone (5/-)	20	20	26/-	..	3 17 0
WestinghouseBrake	12½	14	70/-	..	4 0 0
West, Allen (5/-)	7½	7½	7/3	+6d.	5 3 5

• Dividends are paid free of Income Tax.

Stocks & Shares (*Continued from page* 318)

good dividend payer. In each of the past four years, dividends of 10 per cent. accompanied by a bonus of 1 per cent. have been paid on the ordinary shares, the distribution being well covered by earnings. Of the ordinary stock and shares, of £1 each, there are £4,299,656 in issue, and, in addition, £279,000 in preference shares. The company goes back to 1900 and at various times has acquired boiler works, foundries, etc., in subsidiary companies, while its overseas interests are considerable. The present price of 50s. allows a yield of £4 8s. per cent. on the basis of the 11 per cent. dividend.

Automatic Telephone

A further rise of ⅛ has lifted the price of Automatic Telephone & Electric shares to 61s. 3d. This is double that to which the shares fell at one time four years ago. In 1938, the company started paying a bonus of 2½ per cent. in addition to the usual 10 per cent. dividend, and this has been maintained for five years. It is assumed that the dividend and bonus will be the same in respect of the year which ended last December. The interim dividend of 3 per cent. in September, 1943, is expected to be supplemented by a final of 9½ per cent., to make 12½ per cent. as before. Out of the issued capital of £1,244,000, £100,000 is in "A" deferred shares of £1 each which are all held by British Insulated Cables, Ltd.

"Signals"

Following upon the announcement by the Consolidated Signal Co. that its ordinary dividend was to be raised from 24 to 27½ per cent., the accounts show that the increase is due, of course, from the extra dividend paid by the Westinghouse Brake & Signal Co. The Consolidated Signal draws its income from Westinghouse Brake shares. The present price of Westinghouse Brake shares is 70s. and, mathematically speaking, Signals should stand at £7 13s. 6d. against the current price of 5⅞ ex dividend. The reason for the discrepancy, as pointed out here recently, is that in the Westinghouse Brake shares a better Stock Exchange market obtains. For anyone wishing to take an interest in Westinghouse Brakes, the cheaper plan is to buy the Consolidated Signal Company's shares.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

ALLMÄNNA Svenska Elektriska Aktiebolaget.—" Means for amplifying a direct current by transductor action." 8719/42. July 25th, 1941. (559303.)

British Insulated Cables, Ltd.—" Poles, posts, standards, masts, etc." 13965/42. March 11th, 1942. Addition to 553396. (559280.)

British Thomson-Houston Co., Ltd.—" Refrigerators." 8945/42. July 1st, 1941. (559169.) " Electric arc-welding apparatus." 10944/42. August 9th, 1941. (559178.) " Gas-blast electric circuit-breakers." 10876/42. August 5th, 1941. (559217.) " Electrode feed control apparatus." 10970/42. August 12th, 1941. (559244.) " Gas-blast electric circuit-breakers." 11305/42. August 22nd, 1941. (559246.) " Methods of coating electric-discharge tubes." 11955/42. September 2nd, 1941. (559253.)

British Thomson-Houston Co., Ltd. (General Electric Co.).—" Cooling arrangements for gas turbine." 13393. October 17th, 1941. (559231.)

A. C. G. Buller and H. S. Kendall-Torry.—" Low-voltage safety electric soldering iron of midget size." 11654. August 19th, 1942. (559249.)

Drake & Gorham, Ltd., and J. Newell.—" Supporting arrangements for electric circuit conductors." 13918. October 3rd, 1942. (559319.)

W. C. Fairweather (Singer Manufacturing Co.).—" Electric lighting attachments." 13719. September 30th, 1942. (559278.)

P. M. Gough.—" Means for use in changing the points of overhead trolley wires." 13046. September 16th, 1942. (559186.)

A. Graves, Alltools, Ltd., G. A. R. Tomes and Cinema-Television, Ltd.—" Windows in the envelopes of vacuum tubes." 11681. August 19th, 1942. (559181.) " Thermocouples." 11682-3. August 19th, 1942. (559182-3.)

L. Hartshorn and W. Wilson.—" Electrically operated indicating or measuring instruments." 8585. June 23rd, 1942. (559240.)

A. H. Hunt, Ltd., and C. Whiley.—" Electrical condensers." 9247. July 3rd, 1942. (559304.)

Marconi's Wireless Telegraph Co., Ltd.—" Electric plug-and-socket connecting devices." 8861/42. June 28th, 1941. (559168.) " Television image projection systems and cathode-ray tubes for use therein." 10640/42. July 31st, 1941. (559214.) " Frequency modulation." 16469/42. November 21st, 1941. (559289.) " Frequency modulation receiver." 16807/42. November 27th, 1941. (559290.)

A. L. Mond.—" Electrically heated composite fabrics." 16086. November 13th, 1942. (559322.)

J. F. O'Brien.—" Electricity conductor unit for wiring systems." 8653/42. June 14th, 1941. (559266.) " Electricity contact devices." 18307/43. June 14th, 1941. Divided out of 559266. (559291.)

Siemens Electric Lamps & Supplies, Ltd., and J. N. Aldington.—" Electric discharge lamps." 13745. September 30th, 1942. (559318.)

Siemens Electric Lamps & Supplies, Ltd., J. N. Aldington and A. J. Meadowcraft.—" Metal-vapour electric-discharge lamps." 12092. August 27th, 1942. (559315.)

Square D. Co.—" Wireless communication between aircraft." 10657/42. February 5th, 1941. (559243.) Ditto. 21109/43. Divided out of 559243. (559259.)

Standard Telephones & Cables, Ltd.—" Covering of electrical conductors with insulation." 9212/42. July 11th, 1941. (559209.) " Shielding for communication cables." 11056/42. October 30th, 1941. (559245.) Vacuum tube amplifying apparatus." 12840/42. September 17th, 1941. (559258.)

S. D. Sullam.—" Conduits or tubing for housing electrical conductors and other purposes." 16427. November 20th, 1942. (559323.)

Veritys, Ltd., and J. W. Forth.—" Tubular fluorescent and reflector fittings." 13838. October 2nd, 1942. (559190.)

Vickers-Armstrongs, Ltd., and J. P. Watson.—" Apparatus for automatically controlling the speed of direct-current electric motors." 10564. July 28th, 1942. (559213.)

Westinghouse Electric International Co.—" Automatically reclosing electric circuit-breakers." 14470/42. October 17th, 1941. (559282.)

TRADE MARK APPLICATIONS

RECENT applications for British trade marks include the following, objections against which may be entered within one month from February 23rd.

DAWCO. No. 624,191. Class 9. Electric batteries and flat irons.—E. Dawson (Lamp Factors), Ltd., 10, Gray's Inn Road, London, W.C.1.

DUCAL. No. 625,888. Class 9. Insulated electric cables.—Durham Cables, Ltd., Birtley, Durham.

WARNEGATE (design). No. 626,295. Class 9. Electric batteries.—James Warne, trading as " Westgate House," Westgate House, 6 & 8, Mount Street, Halifax, Yorks.

SYLVANIA. No. 625,550. Class 11. Electric lamps.—Sylvania Electric Products, Inc., 60, Boston Street, Salem, Essex, Massachusetts, U.S.A. Address for service c/o Frank B. Dehn & Co., Kingsway House, 103, Kingsway, London, W.C.2.

LAMINEX. No. 625,875. Class 20. Crates (not of metal) for accumulators, and jars or containers for acids (not being accumulator jars) made of laminated material composed of synthetic-resin impregnated paper, of synthetic-resin impregnated textile material or of a combination of these two materials.—United Ebonite & Lorival, Ltd., Springside Works, Little Lever, nr. Bolton, Lancs.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Belfast.—March 7th. Electricity Department. Stores. (February 11th.)

Londonderry.—March 7th. Town Council. House service cut-outs, joint box compound, meters, electrical accessories, lubricating oils, transformers and kiosks, cables and cable covering tiles. Specifications from the Electricity Department, Strand Road.

Manchester.—March 22nd. Electricity Committee. Service cut-outs and cables. (See this issue.)

North-West Midlands.—May 10th. Joint Electricity Authority. Piping equipment and overhead electric cranes. (See this issue.)

Westhoughton.—March 8th. Urban District Council. Supply of electric lamps for the year ending March 31st, 1945. Particulars and forms of tender from F. H. Walker, surveyor, Town Hall. (Stamped addressed foolscap envelope required.)

Wortley.—March 31st. R.D.C. Electrically driven borehole pumping unit. J. Morton, Council Offices, Grenoside, near Sheffield.

Orders Placed

Australia.—NEW SOUTH WALES.—State Electricity Commission. 22-kV compound-filled switchgear and accessories (£65,599).—A. Reyrolle & Co.

Sydney County Council. 25-pair lead-sheathed telephone cable, Spec. 646 (£1,631).—British Insulated Cables. 30-MVA regulating auto-transformer for Pyrmont power station, Spec. 674 (£13,475).—Siemens (Aust.) Pty.

Durham. — County Council. Accepted. Reconditioning batteries at the Richard Murray Hospital (£334).—Falconar Cross & Co.

Two electric cookers for Easington Institution (£73).—North Eastern Electric Supply Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Houses (40) for Corporation; city architect.

Altrincham.—Additions to works, Broadheath; C. S. Maden & Co., Ltd., Atlantic Street, Broadheath, Altrincham.

Brighouse.—Extensions to workshop; S. Marshall & Sons, Ltd., quarry owners, Brookfoot Lane, Southowram.

Chester - le - Street.—Miners' hostel; I. R. Rutherford & Sons, The Minories, Jesmond, Newcastle-on-Tyne.

Clydebank.—Additional 200 houses; burgh surveyor.

Easington.—Miners' hostel; H. E. Pitt, Ltd., Leopold Street, Millfield, Sunderland.

Flaxton.—Shopping centre, Yearsley Grove; York Co-operative Society, Ltd., Railway Street, York.

Gloucestershire.—Kitchen and dining room, High Street School, Kingswood, near Bristol; county architect, Shire Hall, Gloucester.

Hastings.—Central kitchen, Battle Road, Silverhill; borough surveyor, 37, Wellington Square.

Hendon.—Central kitchens at Watling and Clitterhouse; borough engineer, Hendon Town Hall, N.W.4.

Hyde.—Additions to oil works, Manchester Road; Arcoline Lubricants (1935), Ltd., Manchester Road.

Extensions to offices at works, Alma Mills, Furnace Street; Fletcher Miller, Ltd., Alma Mills, Furnace Street, Hyde.

Leamington Spa.—Wartime nursery, Pound Lane, Lillington (£1,967); Stowe and Co., builders, 111, Regent Street.

Leeds.—Steel building; Domewood, Ltd., Newlay, Bramley, Leeds.

London.—ST. PANCRAS.—Nursery, Camden Road (£1,536); J. H. & W. Heal, Ltd.

Additional storey, printing works, Gray's Inn Road; Daily Sketch, Ltd.

ST. MARYLEBONE.—Hostel and offices, Devonshire Street and Beaumont Street; Peacock & Goddard.

Malton.—Building, 90 ft. by 30 ft.; Ward Bros., Sherborn, near Malton.

Middlesex.—Staff accommodation, Central Hospital (£4,000) and staff bungalows, Sawbridgeworth (£5,215); county architect.

Newcastle-on-Tyne. — Reconstruction of premises in High Friar Street, for E. Turnbull; Marshall, Tweedy & Bourn, architects, Grainger House, Blackett Street, Newcastle.

Northamptonshire.—Central kitchen, Wootton (£3,000); county architect, Northampton.

Stratford-on-Avon.—Boiler house; N. C. Joseph, Ltd., Aluminium Works.

Surrey.—Buildings, dairy, etc., at Central School, Lingfield (£1,425); county architect, County Hall, Kingston-on-Thames.

Tynemouth.—Two school kitchens; borough engineer.

Factory for Charles Clay & Son, Ltd.; Dr. Oscar Faber, architect. London.

Additional workshops for Smith's Dock Co. Ltd.; W. Stockdale, architect, 73 Howard Street, North Shields.

Wallsend-on-Tyne.—An additional floor to the offices of Wallsend Slipway & Engineering Co., Ltd.; Purdie & Lumsden, Ltd., Oxford Street, Newcastle-on-Tyne.

Wolverhampton.—Extensions to Wolverhampton and Staffordshire Technical College; Secretary, Technical College, Stafford Street.

Wood Green.—Partial rebuilding, 175-7, Albert Road; Enright & Turner.